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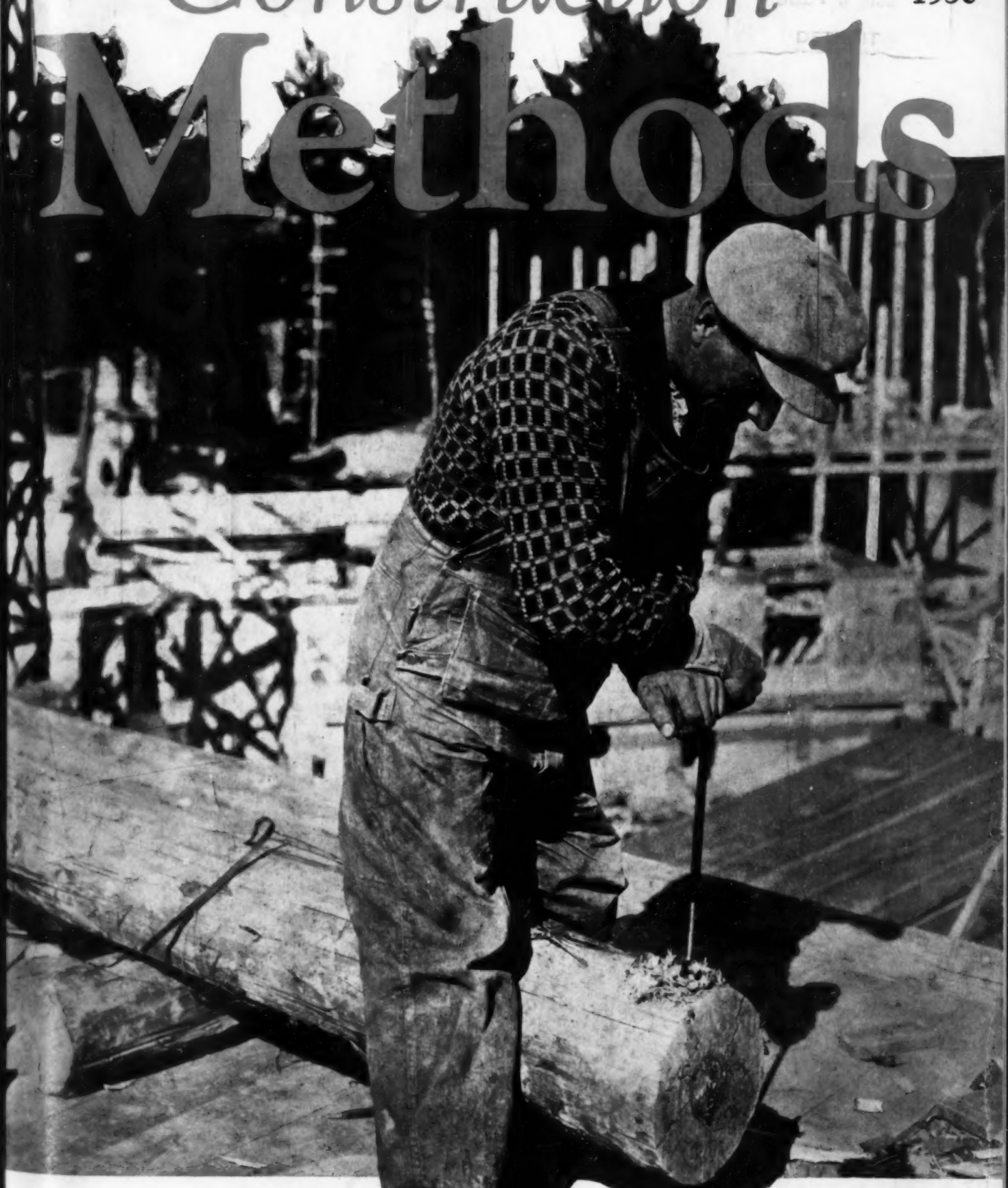
Construction Methods

July
1930



Building a Log Lodge in the Canadian Woods at Lucerne-in-Quebec

McGRAW-HILL
UBLICATION

A MONTHLY REVIEW OF P ACTICE AND EQUIPMENT

Ingersoll-Rand Portables Have Many Superior Features of Design

The excellent performance of I-R Portables is due to skillful workmanship, high-quality materials, and many advanced features of compressor design.

Several of these features, including the aftercooler, the radiator guard, and the one-piece, cast-steel frame, are plainly visible. Others, built into the very heart of the machines, include the famous "constant-level" oiling system, which operates without the use of force or suction pumps; the Waukesha motor with dynamic thermostat control; and the "Airsealed" unloader, which provides a reliable and entirely automatic system of compressor regulation.

Every moving part is accessible, so that ordinary adjustments can be made without dismantling compressor.

For a complete description of our latest machines and their various uses, write for illustrated Bulletin 3615.

Ingersoll-Rand

11 Broadway . . . New York

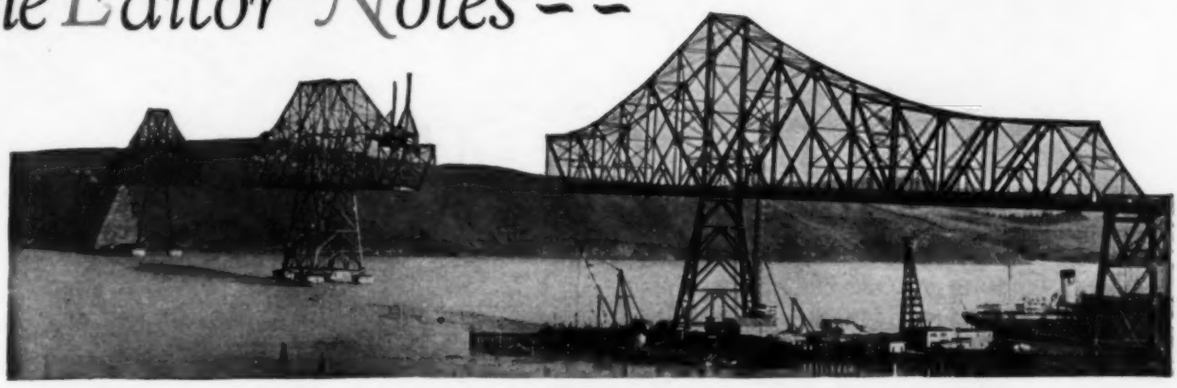
Below: Ingersoll-Rand 310-ft. portable compressor with steel wheels and solid rubber tires.

246-PC

CONSTRUCTION METHODS, July, 1930. Vol. 12, No. 7. Published monthly. McGraw-Hill Publishing Company, Inc., Tenth Avenue at Thirty-sixth Street, New York, N. Y. $1 per year; 10 cents per copy. Entered as second-class matter, October, 1926 issue, Vol. 8, No. 19, at the Post Office at New York, N. Y., under the Act of March 5, 1879. Printed in U. S. A.

TECHNOLOGY DEPT.

The Editor Notes - -



Safety Hints on Building Work

HOD HOIST accidents on building construction received the greatest share of attention from contractors and their superintendents and foremen at a recent meeting of the Committee on Accident Prevention of the Building Trades Employers' Association, under the chairmanship of Henry W. Lohman, vice-president of James Stewart & Co., Inc. Among the safety practices suggested were the following: (1) Inclose hoist hatchways with wire screen, using a protecting bar at openings; (2) In building safety enclosures around openings set the planking *vertically* so that men can not use it as a ladder or remove boards easily; (3) For enclosures, expanded metal, instead of wire mesh, is preferred by one contractor on the ground that it can not easily be punctured or torn and caught by the hoist platform so as to wreck the enclosure; (4) On safety gates at hatchways electrical interlocking devices may be installed to prevent operation of the hoist platform if a gate is open; (5) When a sub-contractor hires a hoist from the general contractor he should take over the general contractor's bell operator, to prevent improper or unauthorized signalling; (6) Glaziers should be equipped with buckets to receive cuttings of glass instead of allowing them to drop on the floor; (7) General contractors should build all major scaffolds and be responsible for their strength.

Mississippi Revetment

While willow mattresses are still being employed to protect the banks of the Mississippi River against undercutting and washing away the present trend is toward a wider use of concrete revetment. The Corps of Engineers, U. S. Army, has developed two radically different types of concrete revetment, both of which present interesting and decidedly unusual construction problems in both casting and laying. This month's issue (p. 56) illustrates and describes the so-called articulated concrete mat while in the March number were published construction details of the lapped-slab type of revetment.

A comparison of the two articles, therefore, will serve to illustrate how the main objectives of river bank protection and channel stabilization are being attained by methods and equipment that bear slight resemblance to each other. While the procedure in the casting of the slabs, in the two cases, is somewhat similar (both involving barge-mounted paving mixers and boom-and-bucket distributors) the laying operations are not at all alike. The lapped slabs, each 6x11 ft. in area, are sunk to the river bottom, one by one, with the aid of guide cables from submerged header blocks, while the articulated mat, as its name implies, is launched from a barge as a huge flexible blanket of concrete, made up of reinforced block units wired and clipped together. Sinking operations for the two types of revetment involve methods and plant without precedent on other types of construction. Engineers and contractors without experience on the Mississippi work, therefore, will find something out of the ordinary in the revetment articles which form part of the series on "The Defense Against Old Man River."

CONSTRUCTION METHODS

A monthly review of modern construction practice and equipment

ROBERT K. TOMLIN, *Editor*

Editorial Staff

VINCENT B. SMITH NELLE FITZGERALD

J. I. BALLARD (San Francisco)

WILLARD CHEVALIER, *Publishing Director*

A McGraw-Hill Publication

Tenth Avenue at 36th Street, New York

A Year's Work in Road Building

FIGURES on the dollar value of contract work performed during 1929 under the jurisdiction of the New York State Highway Department have been assembled by the state highway chapter of the Associated General Contractors. They are interesting as indicating the range in size of individual highway construction organizations and the yearly scope of their operations. Last year 187 contractors on state highway construction in New York performed work costing $39,804,000, or an average of $213,000 per contractor. Two of the contractors did more than a million dollars' worth of work during the year; 13 were in the $500,000-$1,000,000 class; 90 in the $100,000-$500,000 class; and 82 in the group under $100,000. About half as much work as was actually performed during 1929 was carried over into 1930; it amounted to $21,400,000 and involved 123 contractors, or an average of $174,000 per contractor.

Core Drill Fittings Standardized

New commercial standards for diamond core drill fittings have been adopted as the result of efforts by the Bureau of Standards to secure cooperation between manufacturers and drilling contractors. The aim of the new standards is to make diamond core drill fittings, such as bits, casing and rods, as produced by the various manufacturers, interchangeable in the field, in so far as controlling diameters, threads, and dimensions of joints are concerned. Furthermore, the new standards provide a convenient series of nesting casings, permitting three reductions in diameter below a 3-in. hole. The benefit to contractors and other users of the equipment is obvious.

A Master of Methods

NOT long ago A. E. Horst, president of the Associated General Contractors, broadcast an unusually interesting word-picture of the modern constructor and his work. Much of what he said was directed to the man on Main Street and was an old story to those actually engaged in construction.

But one of his paragraphs set forth a truth that deserves repetition and emphasis to the constructors themselves. Here it is:

> "Other industries have been able to reduce their production costs because they have been able to go into mass production of standardized articles. You can't standardize a skyscraper, or a home, or even a private garage, except to a very limited extent."

Check and double-check, Mr. Horst! And it is just this impossibility of standardizing his product that makes it so necessary for the constructor to be expert in the many basic processes that make up every construction job. He must be a master of methods.

He can lower his costs only by knowing how to plant his job and select proper equipment, how to organize efficiently each of the essential operations — excavation, drainage, concrete mixing and placing, steel and timber erection, materials handling and many others — for swift and economical co-ordination into *any kind* of a structure.

That's what makes the successful constructor and that is just the reason for *Construction Methods.* Here we provide a clearing house through which constructors may exchange their ideas and experiences with methods, materials and machinery, and thereby be ready always to tackle the *next* job — whatever it may be.

Willard Chevalier
Publishing Director

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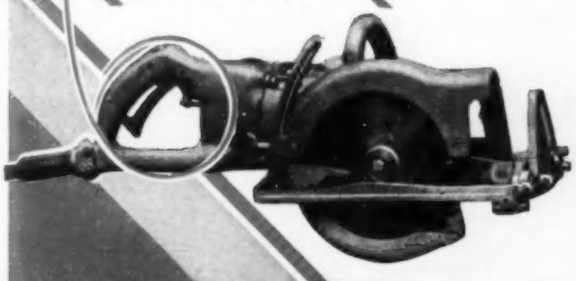

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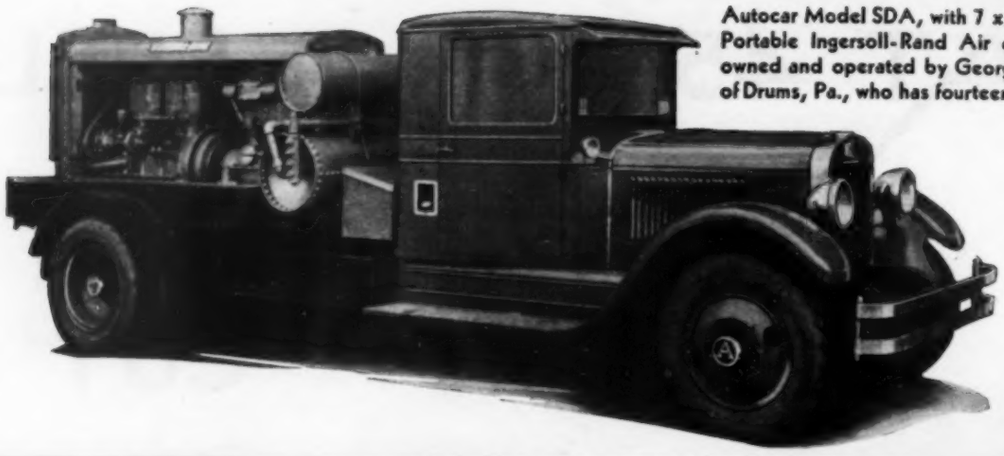

Autocar Model SDA, with 7 x 6 T-20 (G) Portable Ingersoll-Rand Air compressor owned and operated by George C. Hess, of Drums, Pa., who has fourteen Autocars.

AUTOCAR SHOWS ITS METTLE AS AN EFFICIENT MOUNT FOR INGERSOLL-RAND COMPRESSOR

ROAD contracting and other portable air compressor jobs are unusually insistent in their demands for ready and reliable performance of air equipment. Often the progress of the work, and gains or losses on contracts, depend upon fast operations of the "breaker gang".

Shock-proof strength and "stay-put" assembly are two outstanding requisites of the truck chasses which must carry air compressors. The constant vibration of the compressor punishes its "mount".

Autocar has demonstrated its endurance, with power more than equal to the task of taking the compressor to the difficult locations where air is required.

Also, Autocars have proven their economy and efficiency on this type of duty—with more and more of them being enlisted in this service week after week. By low operation and upkeep costs, and by their reliable performance, they save and make money for their owners.

See your dealer or write us for interesting information about this growing use of Autocars.

PRECISION BUILT

AUTOCAR TRUCKS

THE AUTOCAR COMPANY, ARDMORE, PA.

CROWD *out beyond the boom to reach the truck!*

DIG *without any division of engine power between crowd and hoist!*

—without the crowd pulling against the hoist!

The NORTHWEST *for basement work*

THIS IS PAGE 5

The best buy on the market

NORTHWEST ENGINEERING CO.

the world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines

1725 Steger Building — 28 E. Jackson Boulevard

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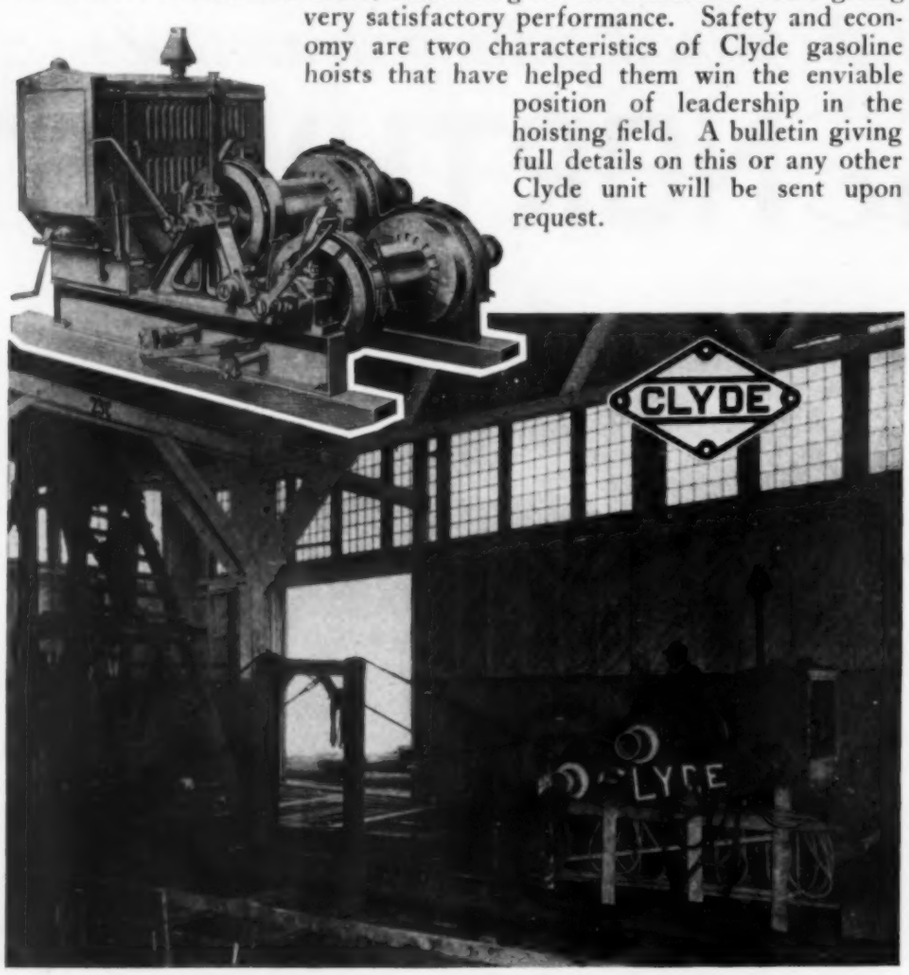
Solving Construction Problems:—

For pile-driving inside a building, it is impractical to use any hoist with boiler. A 55-horsepower, double-drum Clyde gasoline hoist overcame this difficulty for the Jacobson Construction Company on their repair work on the Port of Portland docks, eliminating the fire hazard and also giving very satisfactory performance. Safety and economy are two characteristics of Clyde gasoline hoists that have helped them win the enviable position of leadership in the hoisting field. A bulletin giving full details on this or any other Clyde unit will be sent upon request.



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WILEY WHIRLEYS MADE IT POSSIBLE•

The adaptability of Wiley Whirleys to gantry mounting made possible a large saving to the contractor on the Columbia-Wrightsville bridge on the Susquehanna River. A 5600 foot timber trestle had to be built parallel with the bridge to accommodate two hauling tracks and a track for the Whirleys. The problem was to keep the trestle as narrow as possible to keep down the cost. The solution was to mount six Whirleys on portal gantries which permitted the hauling tracks to pass underneath without interference with the Whirleys.

Wiley Whirleys can be mounted on gantries, barges, piers, track wheels, or skids and rollers, and, with gantries and track wheels, may be self-propelled. Such mobility, together with their full circle swing and capacity to handle heavy loads on their long live booms, make them indispensable on bridge work.

We shall be glad to discuss your problem with you. Write for our Catalog.

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The DAYTON-WHIRLEY CO.
DAYTON, OHIO

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THIS Link-Belt 1½ yard Type K-44 with 45-foot boom is the property of Chas. F. Smith & Son of Dayton, Ohio.

As sub-contractors for Price Bros. on this 60 inch water main job for the Indianapolis Water Company, Chas. F. Smith & Son say the Link-Belt did a fine job of digging and pipe handling.

A cut 16 feet deep by 20 feet wide was made and records of 175 feet per 10-hour day, doing this double job, were frequent.

"You are not exaggerating speed in advertising—it is making three passes, that is, handling five yards per minute," says the machine operator, Carl Thatcher.

"I've handled other makes of power shovels for 20 years, but find nothing equal to the ability of this Link-Belt."

The range of sizes in Link-Belt Crawlers is up to two full yards capacity, heavy duty units, gasoline, Diesel, or Electric Power. Send for Catalog No. 1095.

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All the operating machinery is back of the center pin—giving the crane an extra margin of counterbalance for heavy lifting. Also, as a shovel, more stability in hard digging.

Tapered drums prevent fouling of cable—the cable winds smoothly and lays up evenly, outside to center. The taper also gives greater power at the start—then increased speed.
Note how these drums are split at the center for easy removal.

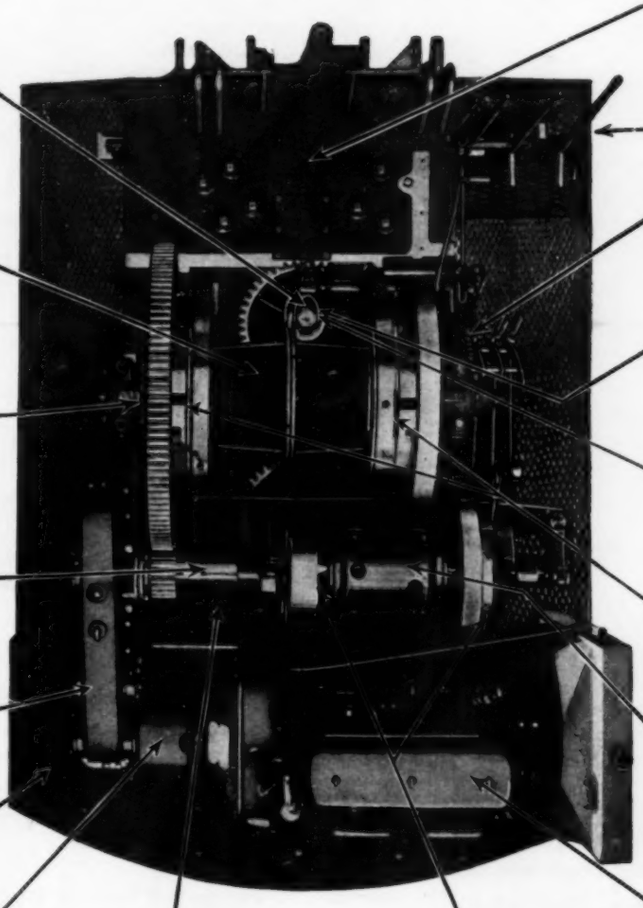
Contracting-band hoist control clutch engaged by means of auxiliary clutch — *lightens the operator's work for speedier operation.*

All shafts are greatly oversize—and every shaft above the deck runs on ball bearings. Double ball bearings on vertical take-off swing shaft. Also on fan shaft.

Transmission running in oil — keeping the oil at correct level gives complete lubrication of all power take-off shafts.

Clear deck all the way around the machine, on both sides and rear—giving complete accessibility to the machinery.

Flexible couplings between motor shaft and transmission—act as shock-absorbers, taking up any strain between these units.



Boom hoist — alloy steel machine-cut worm, and bronze machine-cut wheel, recessed in the revolving frame and running in oil.

Reversing clutches for the swing are greatly oversize — and a large brake is provided for use when the machine is on a grade.

One-piece steel turntable casting provides a rigid base for machinery—keeps all parts in *permanent alignment.* The same type of steel casting is used for the one-piece truck frame.

BUCYRUS-ERIE three-lever control.

Convenient controls for the operator — with handy push-button electric starter for the motor at reasonable extra charge.

Steering control rod runs through the center shaft, which permits complete steering control with the cab in any position.

Center shaft is adjustable from the top, and can be removed without interfering with drum shaft.

Oversize contracting-band hoist clutch and brake, with extra large wearing surfaces that insure long trouble-proof service.

Swing gears held in positive alignment by a box housing, and run in oil.

High horsepower motor gives this *BUCYRUS-ERIE* surplus power. Equipped with vacuum gas feed, air cleaner, automatic throw-out on starter. (Extra.)

A glance tells the story! Every arrow points to an outstanding feature. And taken as a whole they mean that the Bucyrus-Erie 1020 is not just another half yard rig but is a ½-yard machine with real guts! . . . From base to boom sheave every part is built to stand the gaff of steady hard work. Speedy, powerful and dependable is a short-story description of the 1020. Designed for easy accessibility, real mobility and simplicity of control, it gains your respect and regard at once. And because it is Bucyrus-Erie built, you know that operating and maintenance costs are at a minimum.

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CONCRETE'S FINAL INGREDIENT

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S. S. Posey, City Inspector

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Rely on LIME *-tested by time*

IN the construction of the new Austin Dam it was imperative that the concrete be waterproof if a repetition of the failure of the original dam was to be avoided.

According to the report of Frank L. Taylor, Resident Engineer, numerous tests were conducted, resulting in the use of eight pounds of hydrated lime per sack of cement for all concrete in the deck slabs, turbine chambers and reservoir.

The up-stream deck was designed for a maximum head of sixty-five feet of water. S. S. Posey, City Inspector during the period of construction, reports: "The up-stream deck was made watertight with hydrated lime and has shown exceptional tightness for all heads of water."

The Austin Dam is but one of the many concrete structures made watertight by an admixture of hydrated lime. Lime also makes a denser, richer, more uniform mixture which flows freely in the chutes and works better in the forms, preventing honeycombing and reducing finishing costs.

Hydrated lime as an admixture has consistently demonstrated its value in overcoming the difficulties encountered in field practice, by producing a concrete more nearly approaching the quality of laboratory specimens.

For this reason hydrated lime has earned the reputation of "Concrete's Final Ingredient."

Write for new booklet on the proper use and value of hydrated lime in concrete construction.

NATIONAL LIME ASSOCIATION

An organization of leading lime manufacturers formed to encourage a better appreciation of the economic value of lime in all its uses.

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Opening speed is also faster. More concentrated weight on the center shaft exerts a direct pull to overhaul the closing cable drum and open the bucket. Also, Owen Bucket Shells are shaped to spill quickly, discharging their load as soon as they are partially opened.

Write for a Folder which explains all the 17 Points of Owen Leadership. They are worth knowing for good bucket service.

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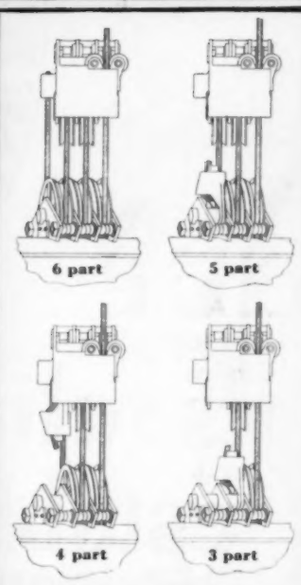

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1. One-piece steel cross-head.
2. No wear in upper or lower arm ends.
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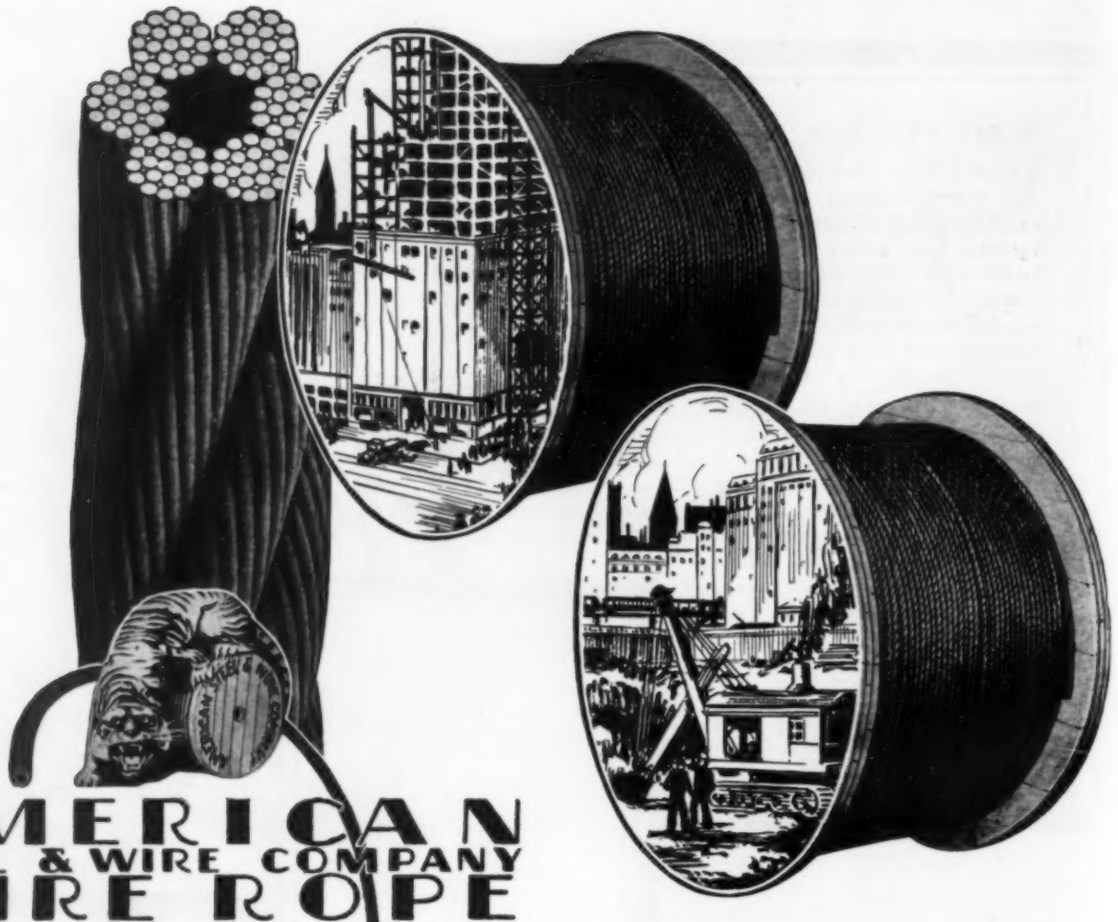

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"HERCULES" (Red-Strand) Wire Rope is dependable because it is made of acid open-hearth steel wire, and every wire put into it is first rigidly tested by us to make sure it meets our exacting requirements as to strength, toughness, flexibility and wearing qualities.

If you want to increase your daily yardage and at the same time lower your actual operating costs, give "HERCULES" a chance to show you what it can do. Its performance record is continually making and holding friends.

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Made Only By **A. Leschen & Sons Rope Co.** *Established 1857*

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Simplified type power clutches
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25 ft. crane boom
Shovel digs 17 ft. 6 in. Dumps 12 ft.

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Weight 10 tons with attachment
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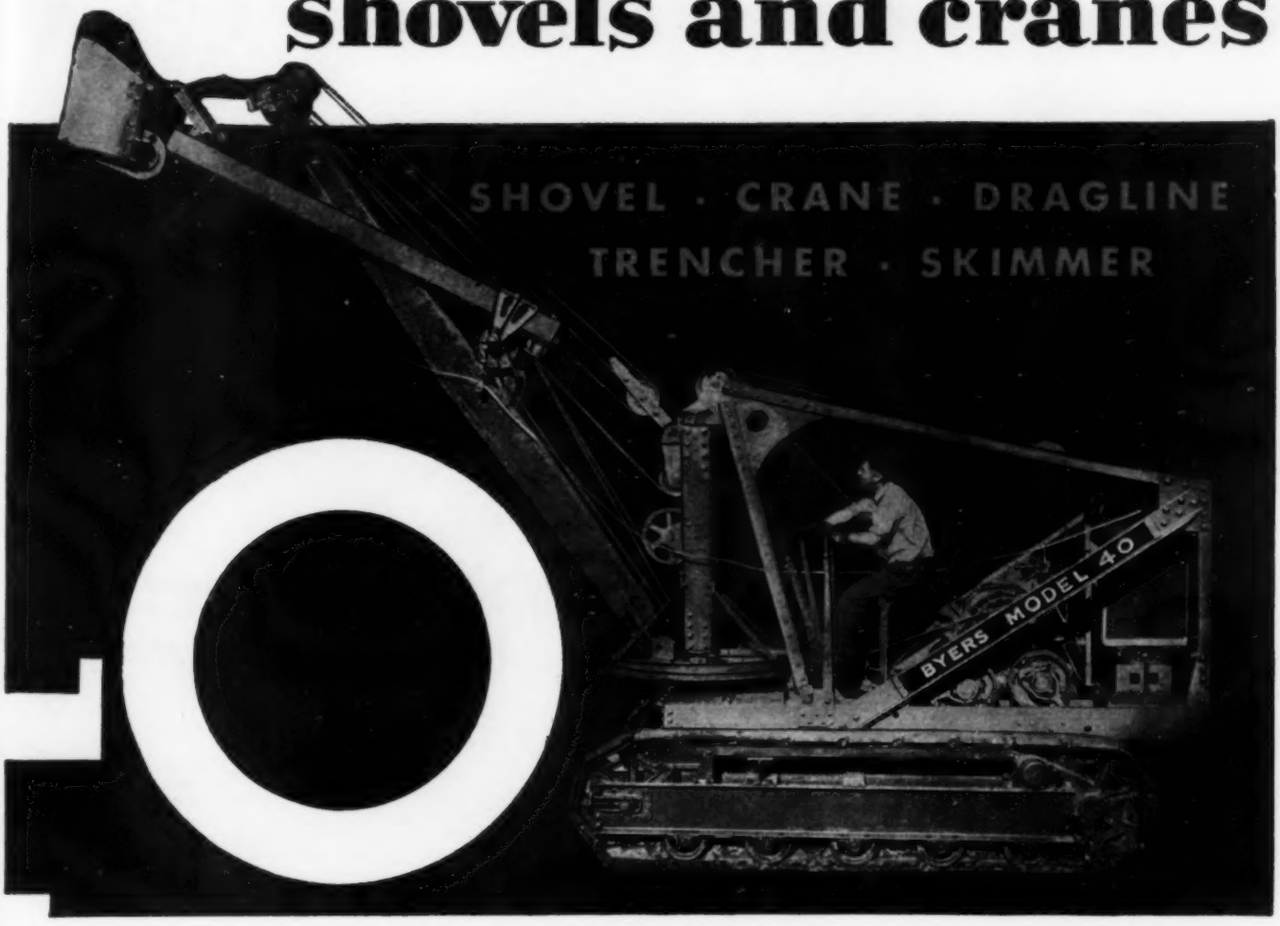
2 3000 machines all over the United States and the world—

3 Experience in building ½, ¾, 1 and 1¼ yd. machines of high quality—

4 Basic machinery design proved correct and adapted to all models—

BYERS
A WORTHY ADDITION TO

DEVELOPMENT
shovels and cranes



WITH this *four-square background* The Byers Machine Company naturally becomes the logical manufacturer to supply the much needed clean-up BYERS MODEL 40 light utility tool.

Model 40 is in a class by itself—it performs economically and fast on many little jobs around big projects that heretofore have been handled by half-yard equipment or by gangs of men.

Model 40 can also earn its way by doing small jobs alone. It will pay dividends regularly on projects of substantial size.

A machine of this type (weighing only 10 tons complete) and selling for a price as low as this has never before been produced with quality construction features contained in Byers Model 40.

Take a good close-up look at this worthy addition to Byers full circle line. Catalogs, photos, specifications awaiting your request.

THE BYERS MACHINE COMPANY - *RAVENNA, OHIO*

Builders of 3/8 - 1/2 - 3/4 - 1 - 1 1/4 yd. Machines

SALES AND SERVICE THROUGHOUT THE COUNTRY

model 40
BYERS FULL CIRCLE LINE

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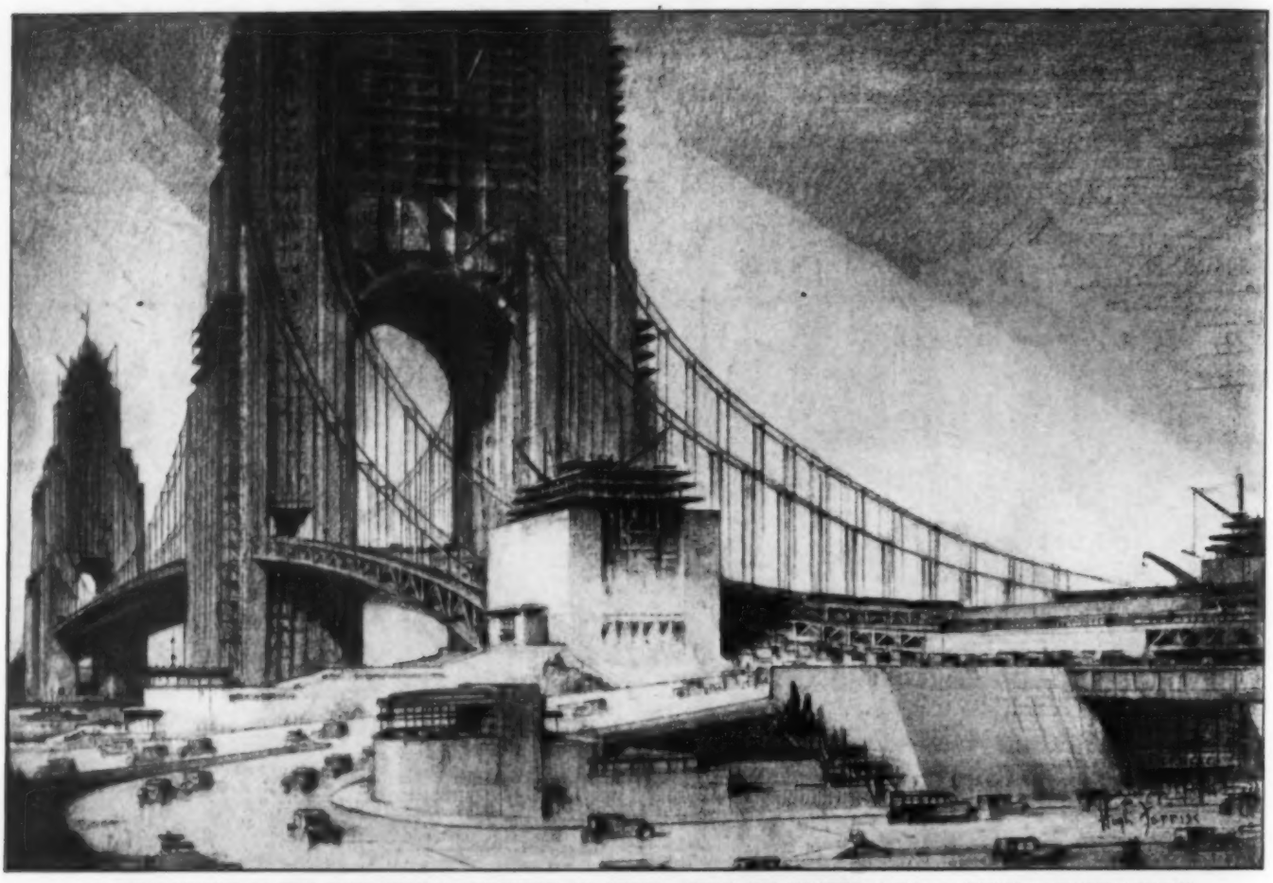

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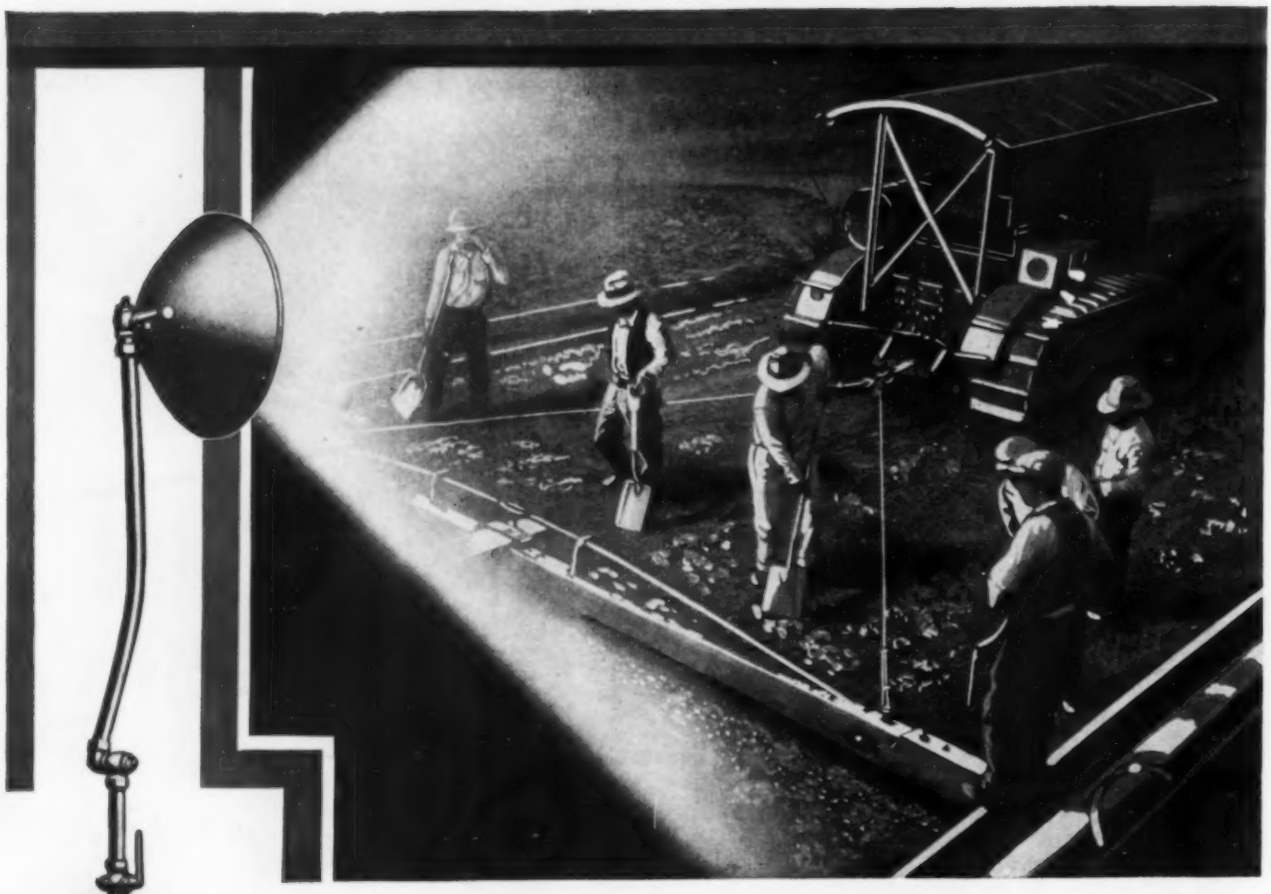

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LAY-SET

PRE-FORMED WIRE ROPE

This is an actual photograph of a piece of Lay-Set Preformed Wire Rope. Note that the end is not seized. Ordinary wire rope, when cut, unravels; the strands and wires straighten out as the confined internal stress is liberated.

HAZARD announces a significant new name in wire rope —"Lay-Set"— (formerly Flex-Set).

This new name more readily associates this familiar rope with its preformed construction—for preforming "sets" each wire and strand to the exact shape it assumes in the finished rope.

Rope users everywhere are turning to preformed rope because preforming entirely eliminates the internal stresses inherent in ordinary wire rope, thereby removing the cause of most early rope failures.

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"LAY-SET" Preformed Wire Rope is carried in stock by the branches and dealers listed. Specify it for your next rope requirement.

Outstanding Advantages of LAY-SET

1. No internal stresses.
2. Handles readily. Not "cranky".
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5. Less wear on drums and sheaves.
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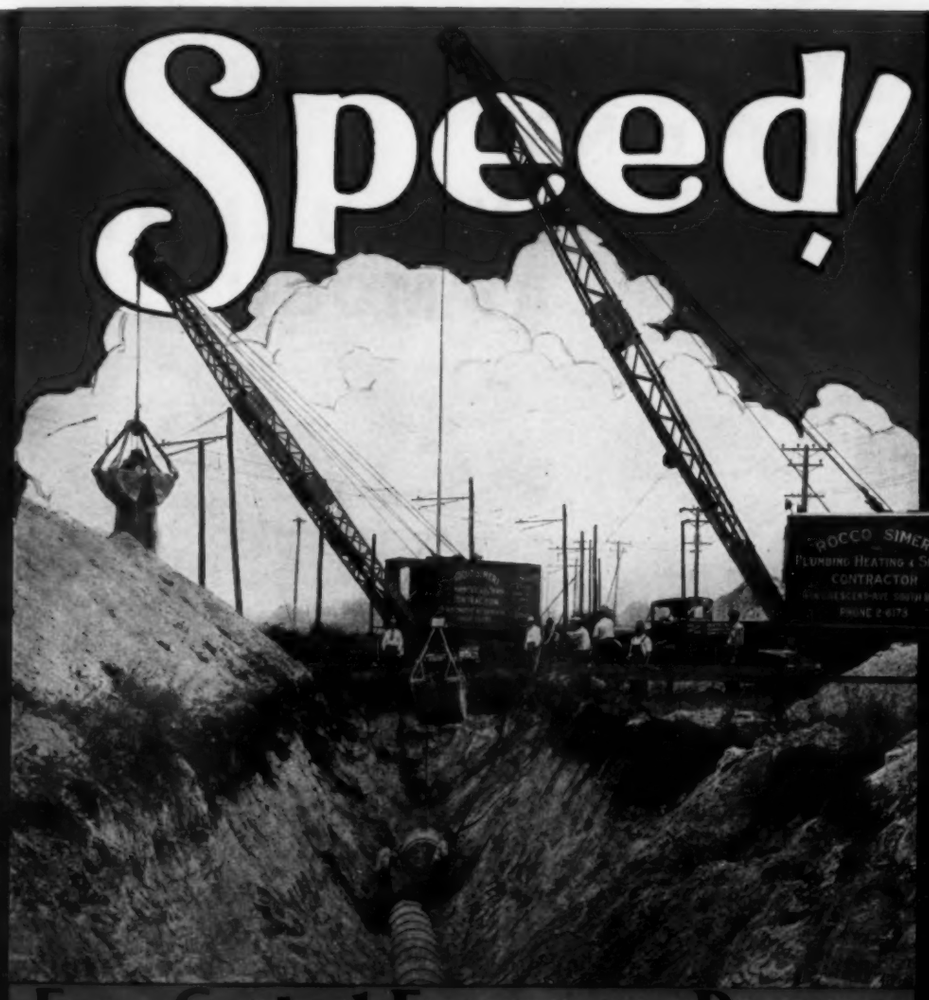
Speed!



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DEEP-ARCH PILING
IN BULKHEAD AT MOBILE, ALA.

Frederic R. Harris, Inc.,
New York City
Consulting Engineers

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General Contractors

This 500-foot bulkhead was constructed with Lackawanna 16 in. x 3/8 in. Deep-Arch Section D P 165, in 45-foot lengths. Depth of water at bulkhead, 20 feet.

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Very truly yours,
FRY BROTHERS.
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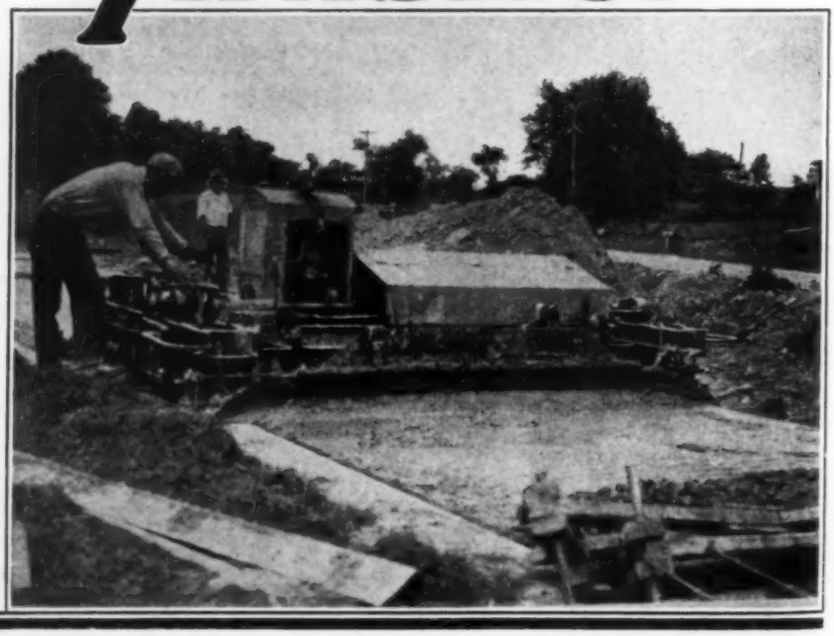

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The Blaw-Knox WAGON GRADER is an ideal dirt moving unit for the Park Department of the City of Battle Creek, Mich.—landscaping—and building a municipal bathing beach.

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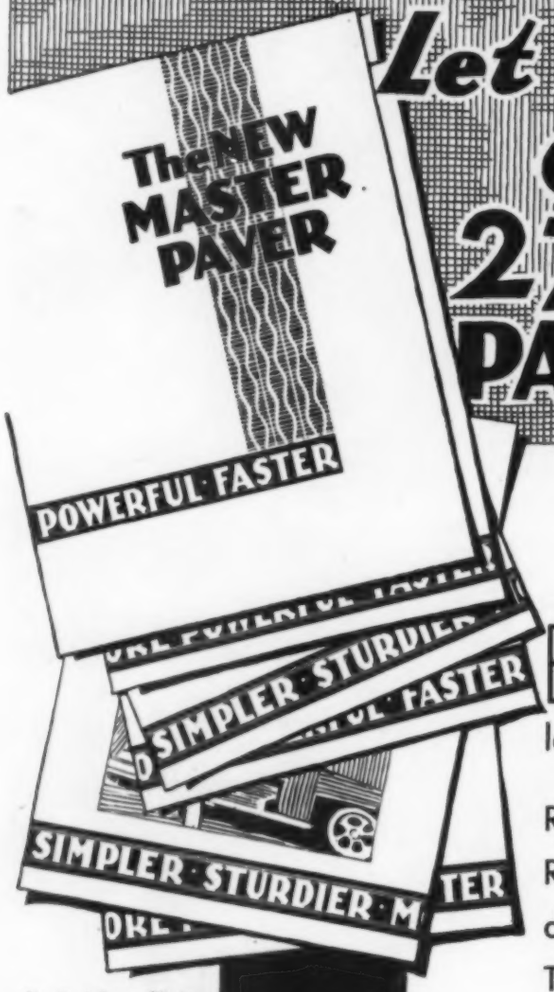

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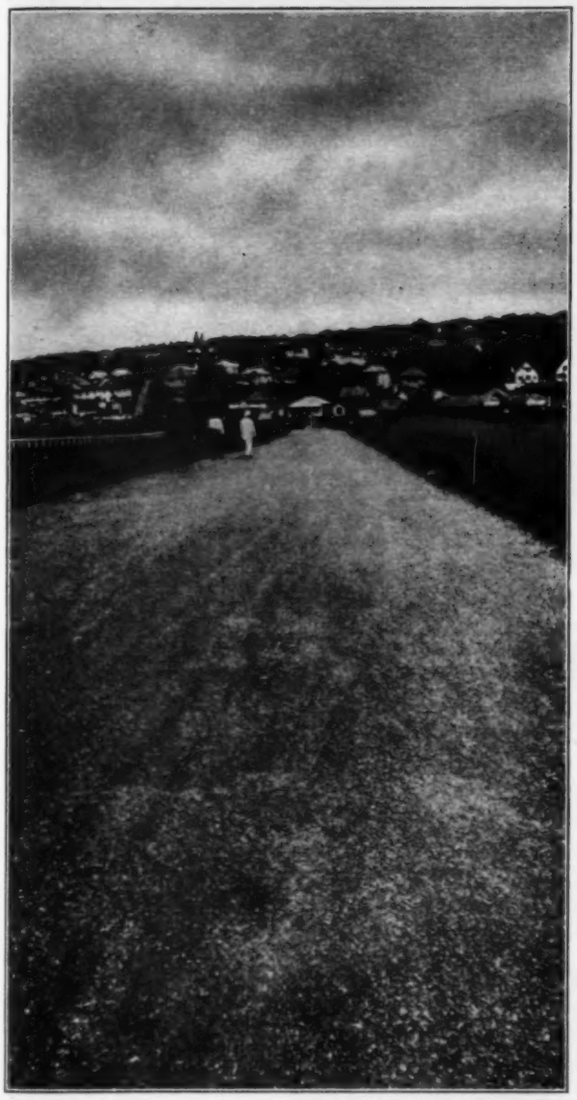

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Durban, South Africa

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St. Francis Church, South Braintree, Mass. Wm. B. Colleary, Boston, architect. This building has been remodeled with concrete into an attractive, modern church. Atlas White portland cement was used for the stucco, for the cast stone and for the colored sidewalk in front of the building.

There's Money For You In Modernizing » »

THERE are many dwellings, apartments, stores, churches and public buildings in your town which are shabby, down-at-the-heel, downright unproductive to their owners. You can turn such buildings into business for yourself — by showing owners how improvements will add more than they cost to the appearance, sales value and renting value of the buildings.

Look around your town and pick out a few buildings that would look like new if refinished in stucco. (Houses and stores that are for sale and older apartment buildings that are not renting are particularly good prospects.) Point out to the owner how a pure white or light-colored stucco finish will beautify the building, reduce its fire hazard, increase its rental value, lower the cost of upkeep and immediately increase its sales value. You are doing these owners a service by suggesting improvements and at the same time you are creating business for yourself.

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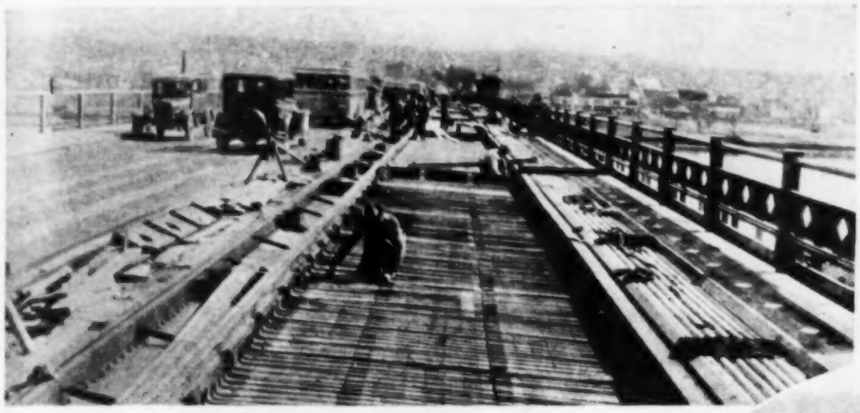
15

Construction Methods

A McGRAW-HILL PUBLICATION—ESTABLISHED 1919

ROBERT K. TOMLIN, *Editor*

VOLUME 12 NEW YORK, JULY, 1930 NUMBER 7



ONE-THIRD OF BRIDGE is resurfaced at a time. New deck is concrete, reinforced with bars.

Contractor Resurfaces Bridge in THREE OPERATIONS

AFTER more than twenty years of satisfactory service, the Anacostia Bridge, crossing a branch of the Potomac at Washington, D. C., is being generally resurfaced. By doing the work in three strips, one strip at a time, two traffic lanes are being left open during the whole course of the job. The old surfacing was of asphalt laid on steel plates. A concrete floor is being substituted, with wood in the central lift span as formerly. At some points, additional steel beams are being put in to relieve over-stressed members; but, in general, the purpose is to resurface without adding to the capacity, which already is adequate.

A peculiarity of the bridge is the distortion of part of its surface by reason of settlement. The bridge has seven spans, three on each side of the central lift span. To the left of the lift, movement of the abutment has made peculiar bumps in all three spans. These factors add to the difficulty of finishing with a grade which is uniform in appearance. The contractor is the Ferris Engineering Co., Pittsburgh.

LIFT SPAN is given usual wood floor, to keep down weight. PNEUMATIC CHISEL *(in oval)* cuts off rivet heads in stripping steel plates which carried asphalt surface of old deck.

This Month's "News Reel"

General Electric Photo

FIRST WELD for Edison Electric Illuminating Company's new 14-story electrically-welded building in Boston, Mass., is made by Mayor J. M. Curley *(left)*, assisted by Charles L. Edgar, president of the company.

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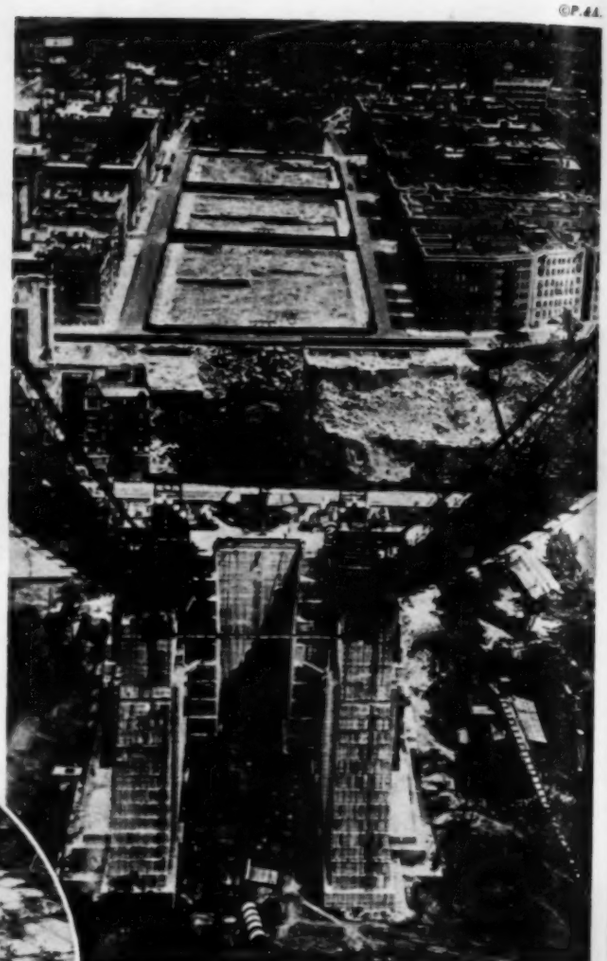


THREE BLOCKS RAZED *(above)* in uptown New York to provide for huge plaza serving Hudson River Bridge.

REVETMENT *(left)* of articulated concrete mats protects Mississippi River banks. (See article, p. 56.)

©Keystone

NEW VICKSBURG BRIDGE, with 825-ft. cantilever channel span, carries both railroad and vehicular traffic across the Mississippi River. Substructure by U. G. I. Contracting Co.; main spans by American Bridge Co., and approaches by Virginia Bridge & Iron Co.

SCREENED INTAKE TOWERS and gates at Saluda dam near Columbia, S. C., an earth structure 7,900 ft. long for hydro-electric development, involving fill of 11,000,000 cu.yd., with puddled core placed hydraulically. W. S. Barstow & Co., Inc., were the contractors with the Arundel Corporation as subcontractor.

TRAFFIC MARKERS *(below)* of Monel metal, a rustless nickel-copper alloy, fastened around a cast-iron core, replace painted lines on Canal St., famous thoroughfare of New Orleans.

©Wide World

FOR OLYMPIC GAMES, Los Angeles, Calif., is completing construction of large concrete stadium in which track and field events will be staged. Concrete for seat tiers is delivered by hoppers on motor trucks running on rails.

Steel COFFERDAM TRUSSES *Simplify Construction of*

TIMBER GUIDES in sand and gravel soil just above water level start arch-web steel sheet piles on line. Inside piles have 12-in. I-beams riveted to them.

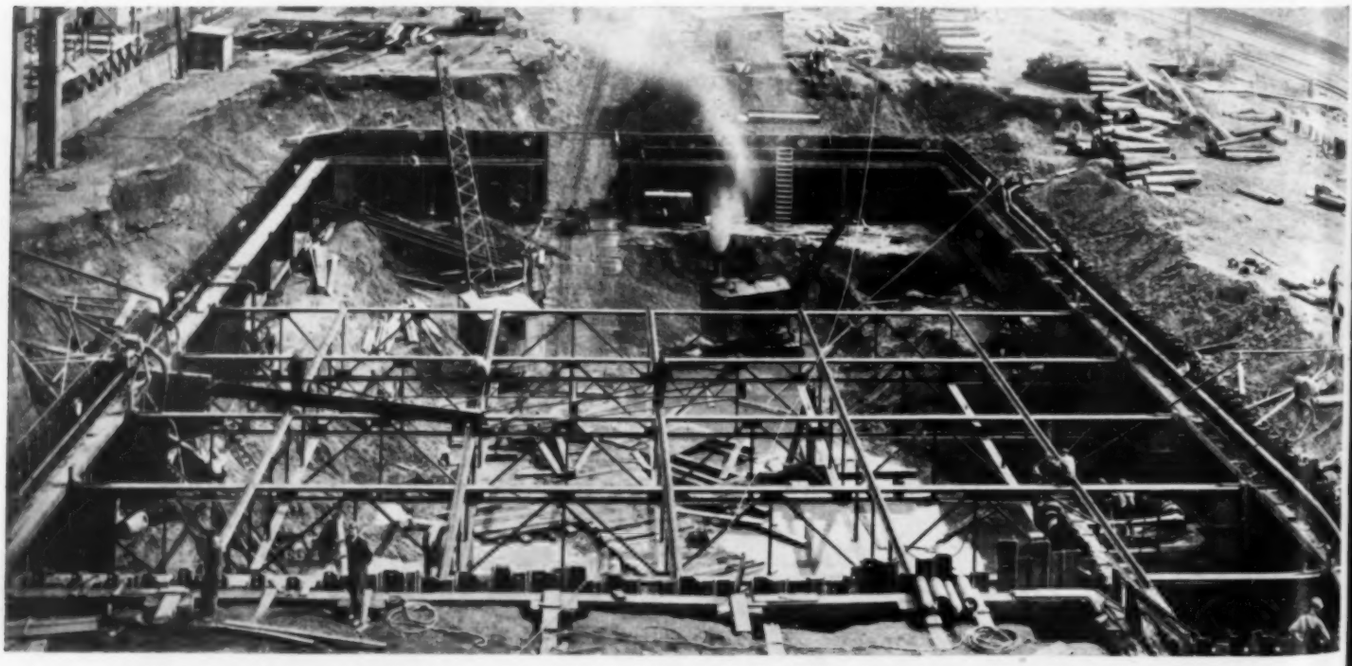
A STEEL-TRUSS bracing frame for a sheet-pile cofferdam, 118x187 ft. in plan, and a well-point drainage system enabled the Byllesby Engineering and Management Corporation to complete the turbine room foundation of the Duquesne Light Co.'s new James H. Reed power station in the coarse sand and gravel soil of Brunot Island, Pittsburgh, to 22 ft. below water level, in one construction operation. The methods adopted by the builders permitted shovel excavation, with truck hauling, to foundation level and also, assured solidity of the concrete mat by elimination of disintegrating sand boils.

The James H. Reed power station is designed to accommodate two 60,000-kva. units, only one of which is included in the present installation. The turbine room basement has a foundation slab 14 ft. thick, with hotwell pits 8 ft. deep. Adjoining the turbine room, under the same roof, is the boiler room, with a foundation of cast-in-place concrete piles.

Construction Conditions — Brunot Island is a sand and gravel bar in the Ohio River, about 1½ miles below the confluence of the Allegheny and Monongahela Rivers. The gravel is very coarse, containing many small boulders. Pool level at the island is 704; but spring floods, during the construction of the turbine room basement, raised the ground-water level to heights varying between El. 712 and El. 715. The surface of the ground is approximately at El. 730, and the bottom of the concrete foundation pad is at El. 692. A large power plant already was in existence on the island.

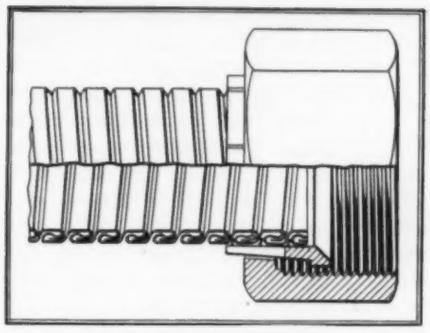
General Methods—Opening a hole 187x118 ft. in plan, against a 22-ft. average head, in this kind of soil, presented serious difficulties which threatened to make the cost of construction very high. The builders developed a scheme which simplified construction and kept the costs within reason.

They first excavated through cinder fill down to the sand and gravel just above water level and, then, drove arch-web sheet piling, reinforced with riveted I-beams, to form a cofferdam extending 10 ft. below the bottom of the proposed excavation. Along the inside of these sheet-pile walls, the constructors sank a row of well points and connected them to header pipes above the ground-water level. With the well



BRACING TRUSSES are set behind ¾-yd. shovel as it excavates to within 6 ft. of final grade. Trusses are received in halves and are bolted in center; struts are bolted at each truss. Pumps to operate well points can be seen alongside cofferdam walls.

and WELL-POINT SYSTEM
Power House Foundation

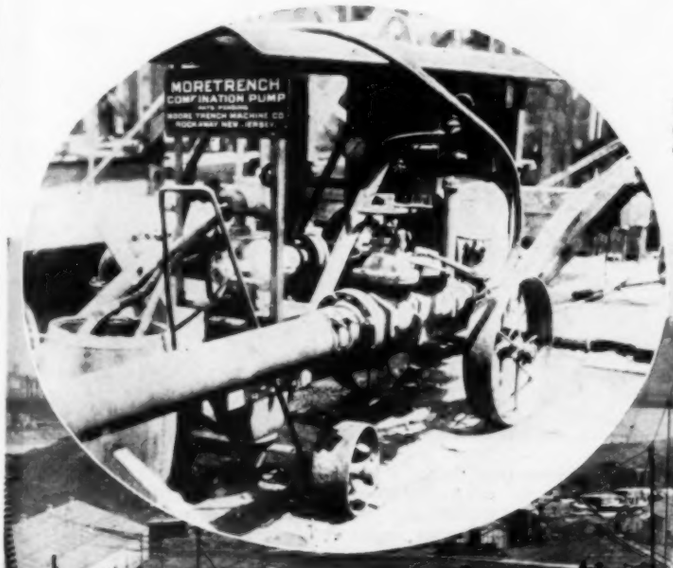


DETAIL OF BRONZE HOSE and connection used to carry superheated steam.

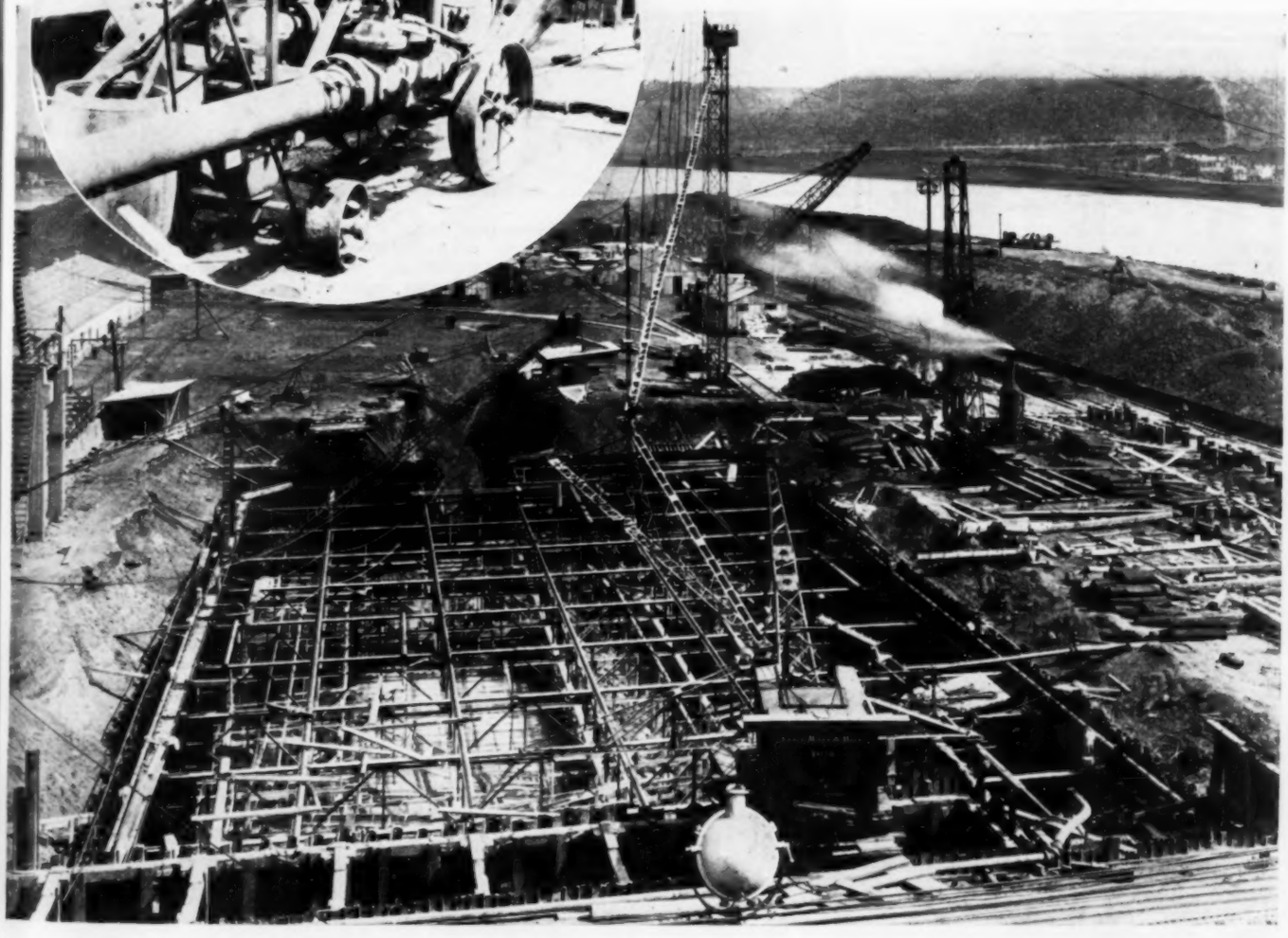
points in operation, shovels excavated to 8 ft. below water level, and the framework of steel trusses was erected to brace the cofferdam. Workmen installed a second set of well points connected to header pipes at this lower level and brought down the well points previously installed to the same level. The complete set of well points then extended to 8 ft. below the bottom of the proposed excavation and 2 ft. above the bottom of the steel sheet piles. A ¾-yd. shovel excavated to 9 ft. below the bottom of the bracing trusses, and two small shovels then operated in the 9-ft. clearance to take out the last 6 ft. of excavation. Below the bracing trusses, the constructors left sloping earth banks to brace the cofferdam walls.

Excavating and Hauling—A gap was left in one end of the cofferdam for a ramp up which trucks could haul the spoil. Twelve 5-ton trucks, ten Macks and two Whites, were the maximum number hauling from the shovels at the bottom of the excavation. In hauling the spoil from the last 14 ft. of excavation, a 75-hp. electric hoist was placed at the top of the ramp to assist the trucks up the steep slope. The haul from the cofferdam was a little more than ¼ mile.

An Erie ¾-yd. steam shovel carried the excavation down to 9 ft. below the



PUMP *(left)* is one of four employed to operate 175 well points.



SWINGING CHUTES distribute concrete from end of long chute suspended from cable. To reduce load on tower, free ends of swinging chutes are tied down to trusses, dispensing with counterweights, and 100-ft. Chicago boom on A-frame and 45-ft. crane boom help to support chutes.

bracing trusses. The trusses were set behind this shovel as it progressed with its last lift of excavation. Two small gasoline shovels, a ¼-yd. Universal, and a ⅜-yd. Insley, able to operate in the 9-ft. clearance under the trusses, took out the last 6 ft. to El. 692.

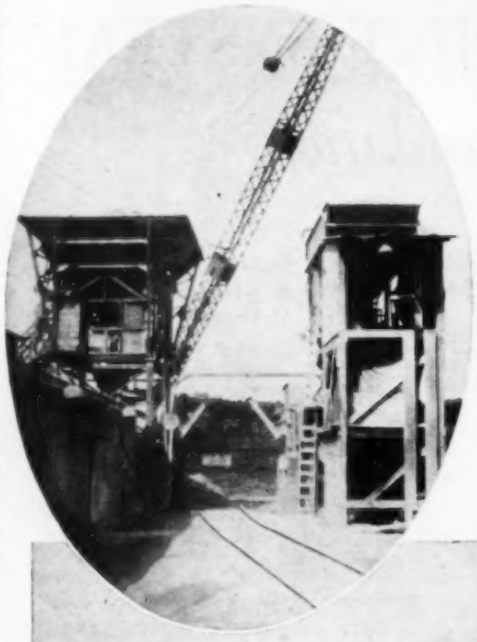
Excavation by shovels proved decidedly more economical than the method, originally proposed, of digging with clamshell buckets through the bays of the bracing frame.

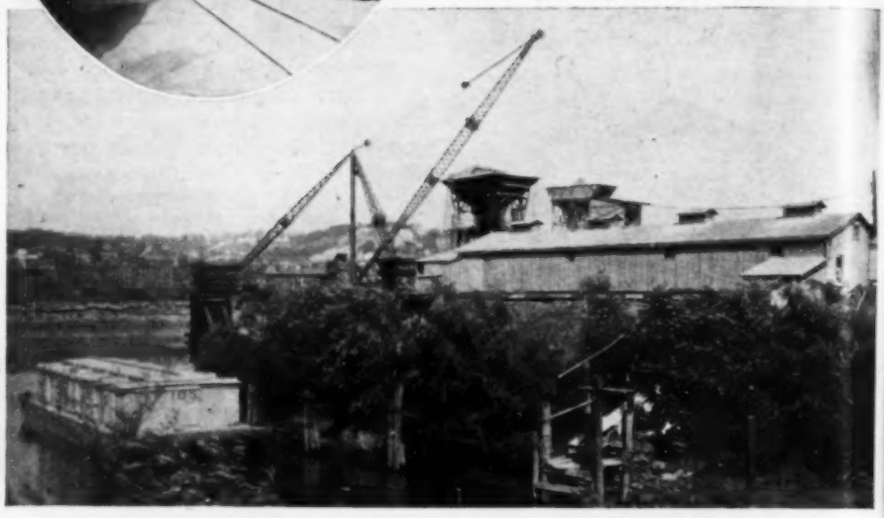
Cofferdam—The cofferdam walls contained a total of 500 tons of steel. Jones & Laughlin 14-in. arch-web steel-sheet piling in 40-ft. lengths and weighing 32.5 lb. per foot, made a wall 8 in. deep. Alternate piles (all those on the inside of the wall) had 12-in. 31.8-lb. I-beeam stiffeners riveted on the full lengths of the piles. I-beam wales were bolted to these stiffener I-beams after the piles had been driven.

Driving began as soon as the excavation had been carried to El. 718, about 12 ft. below ground level. Timber guides were set in the ground to start the piles on line. A McKiernan-Terry 9-B-2 steam hammer on the 50-ft. boom of a Link-Belt gasoline crane drove the 40-ft. piles to El. 682, 10 ft. below the bottom of the proposed excavation. To allow for deviation from the normal line in driving the piles, the cofferdam design provided for the insertion of wood blocks between the stiffener I-beams and the I-beam wales.

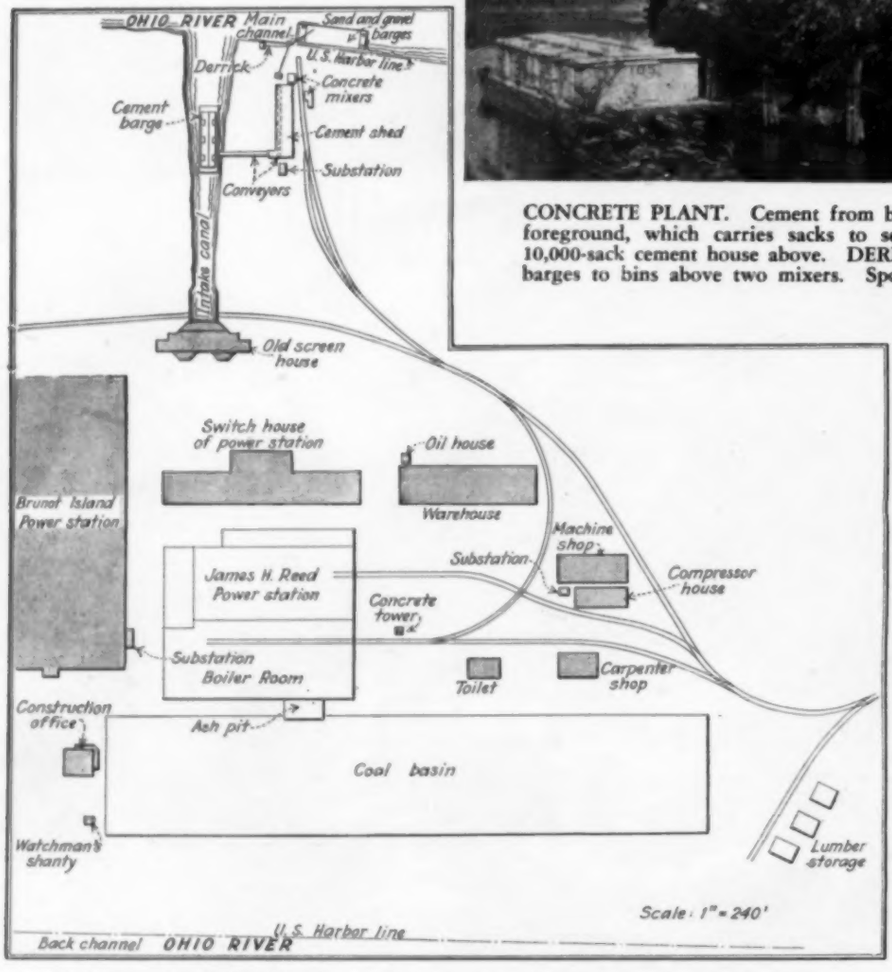
After workmen had set 22-ft. well points at 6- to 7-ft. intervals along the inside of the cofferdam walls, the shovel excavated to El. 706, and the two 27-in. I-beam wales were bolted to the stiffener I-beams on the cofferdam walls. Air drills cut the holes in the stiffeners and wales to match. The top wale was a 101-lb. beam; the heavier bottom wale weighed 160 lb. per foot.

As the large shovel took out the next 9 ft., the constructors installed the steel bracing trusses.





CONCRETE PLANT. Cement from barge is unloaded on to conveyor, in right foreground, which carries sacks to second conveyor running longitudinally in 10,000-sack cement house above. DERRICK *(in oval)* lifts sand and gravel from barges to bins above two mixers. Spouts discharge into railway cars or trucks.



CONSTRUCTION LAYOUT. Warehouse, machine shop, compressor house, carpenter shop, etc., are temporary buildings. Brunot Island power station is older plant.

Bracing System—The entire bracing system, including the wales, weighed 275 tons. Exclusive of the wales, the bracing system consisted of subdivided Warren trusses placed crosswise in the cofferdam and of horizontal struts running lengthwise. Design of the trusses is shown by the diagram.

Drainage System—A four-pump Moretrench well-point system with a total of 175 well points, proved equal to lowering the water level. After excavation had been carried to El. 706, where the full set of well points was installed along the inside of the cofferdam walls, the points were about 3 ft. apart.

Because of the presence of small boulders in the soil, it was impossible to jet the well points. Instead, 4-in. casings were driven with a McKiernan-Terry No. 3 steam hammer, and the points were lowered inside the casings. The casings then were pulled.

CONCRETE CAR carries two ¾-yd. hoppers which discharge into 3-yd. hopper below track at base of tower.

Although the hole was too wide to be kept dry at the center by the well points, the drainage system was able to hold down the water level over the entire area. Only one discolored boil appeared. If boils had become serious, the builders would have put a row of well points down the center of the excavation to lower the hydrostatic head.

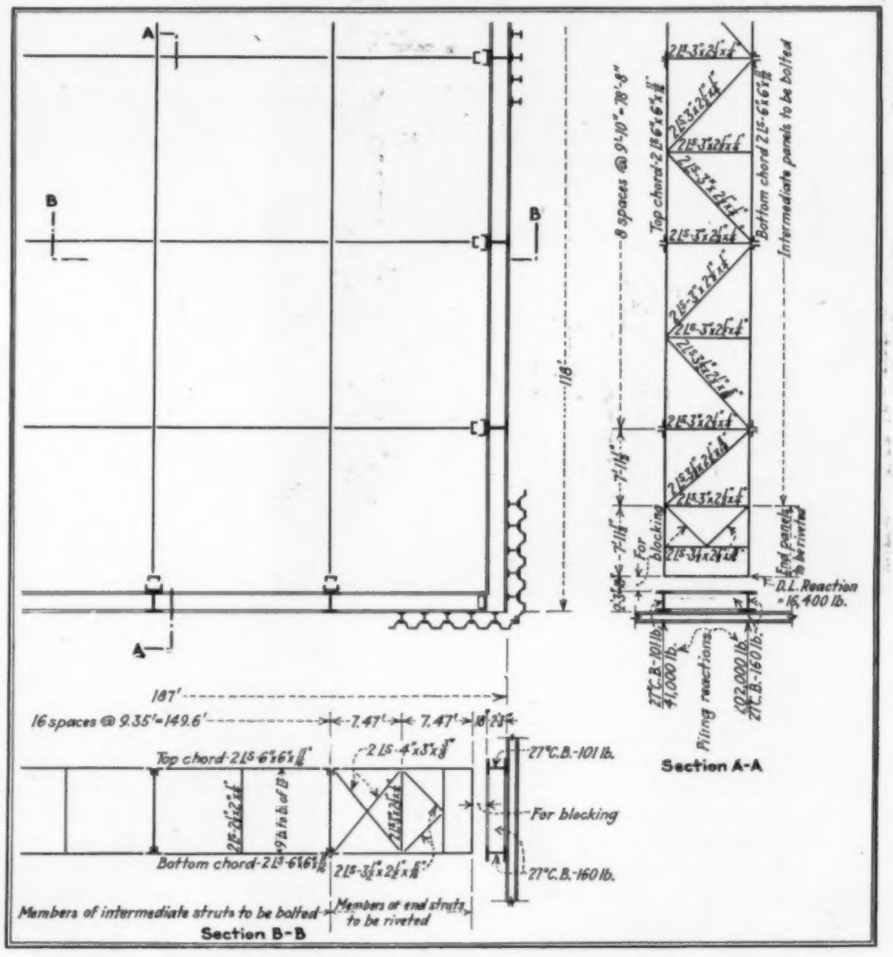
In pouring the 6-ft. foundation pad of the turbine room, the constructors drained 6 in. of surface water into a sump at one corner and pumped out of the sump with two Pulsometers, one having a 4-in. and the other a 3-in. discharge.

Concrete Plant—The 4,500 yd. of concrete in the 6-ft. monolithic pad was placed in 120 hours' continuous pouring, and the 3,400 yd. in the second lift was poured in 96 hours' continuous operation. All concrete was chuted from a 175-ft. angle-iron tower erected near the center of one end of the power station, approximately at the corner of the turbine room. From the tower, a high-line wire-rope cable was stretched to each corner of the turbine room area, and a 140-ft. length of chute was suspended from either of the high-line cables. Two swinging chutes, 50 ft. and 30 ft. long, and an elephant trunk spout, 16 ft. in length, distributed concrete from the end of the long chute to all parts of the foundation. To prevent the tower's buckling under too great load, the builders dispensed with counterweights and tied down the swinging chutes to the bracing trusses.

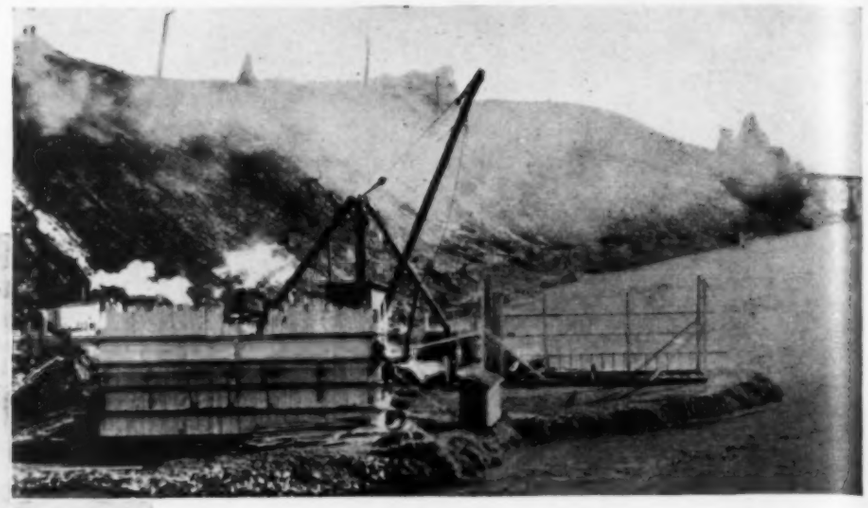
Concrete was mixed at a riverside plant and was hauled about 1,000 ft. over standard-gage railway track to the tower. The mixing plant was equipped with two electrically driven Koehring ¾-yd. mixers, one on each side of the track. All materials were received in barges. Two trains, drawn by Porter 12-ton gasoline locomotives, hauled concrete from the mixers. A train consisted of two flat cars, each carrying two ¾-yd. hoppers. Two 5-ton trucks alternated with the concrete trains to keep the mixing plant operating at full capacity at all times.

Hose for Superheated Steam—To use superheated steam from the power plant at a pressure of 195 lb. and a temperature of 550 deg. F., thus eliminating the need for construction boilers, the builders connected steam hammers and pumps to the plant's pipe lines with metallic hose. The job was equipped with three 50-ft. lengths of bronze hose and four 50-ft. lengths of galvanized steel hose. An accompanying sketch shows the construction of the bronze hose. The steel hose was very similar except for the addition of a braided wire jacket.

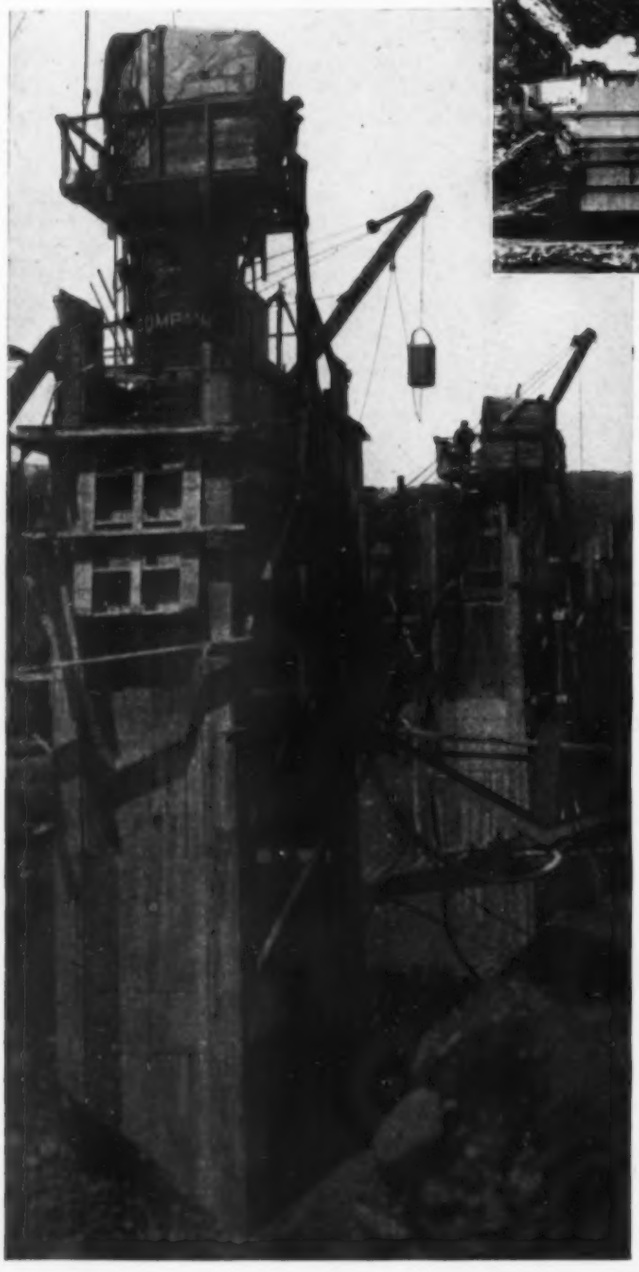
Boiler Room—To carry the boilers in the adjoining portion of the power house, 1,650 Raymond cast-in-place concrete piles were driven to an average penetration of 25 ft. The concrete plant poured a lightly reinforced concrete mat, averaging 7 ft. thick, on top of the piles.



PLAN AND SECTIONS of cofferdam bracing. Trusses are spaced 18.7 ft., and struts, 19.67 ft., c. to c.



JETTY *(right)*, made by filling in river, enables contractor to start caissons on dry land.



CONCRETE CAISSONS, 8x40 ft. in plan, are sunk to bedrock at depth of 100 ft. Alternate sections are carried down simultaneously.

Pneumatic Caissons SUNK 100 FT. *to Form Core Wall of Wyman Dam*

GREAT depth of bedrock under one portion of the earth-fill Wyman Dam made it necessary to sink pneumatic caissons to construct this part of the concrete core wall of the structure. The contractor carried down the wall in large sections by the pneumatic-caisson method and excavated and filled the joints between the sections under air pressure.

Now under construction on the upper Kennebec River near Bingham, Me., the Wyman Dam is to be completed in the spring of 1931. It will enjoy, for a time at least, the distinction of being the largest hydro-electric development in New England. The normal river level will be raised 135 ft., and the three generators will develop a total energy of 105,000 hp.

The power house and spillway are located in the river at the west end of the dam, where the mountain rises sharply, practically from the water's edge. On the east side of the river, however, the comparatively low ground makes it necessary to extend the dam back from the river about 2,000 ft. to meet the high land.

Foundation Conditions—The dam is designed as an earth-fill structure with a concrete core wall—the topography and gravelly soil recommending this type. Preliminary investigation showed the grade of the underlying ledge to be approximately 10 ft. below the river surface at the east bank. Instead of the ledge's gradually rising from that point as the high land on the east was approached, however, the thorough exploration incident to locating the final line of the dam revealed a far different condition. A high promontory on the east bank of the river points up-stream across the line of the dam, necessitating a deep cut for core wall construction. But, of greater consequence, the promontory proved to be a glacial dump—the accumulated débris of an Ice Age river, the choked bed of which lies approximately 100 ft. lower than the ledge at the edge of the Kennebec as now deflected by the dump. The sharp dipping of the ledge to this depth precluded completion of the core wall in open cut and made it necessary to carry the wall down in sections by the pneumatic-caisson method.

Caisson Operations—Excavation on

the line of the wall was carried down in a wide cut to a grade approximately 10 ft. above the river surface. Alternate sections of the wall were constructed as caissons, 40x8 ft. in outside dimensions, with steel cutting edges. The working chambers, 9 ft. high, had heavily reinforced 12-in. walls. Forms were of 2x10-in. matched lumber, the forms being deeply dished at the ends above the working chamber to form a key for the 2-ft. connecting sections between the main blocks. Entrance to the caissons was by means of a 4-ft. shaft through which excavated material was lifted. As excavation proceeded in the working chamber, the caisson settled under the weight of the concrete placed above. When water level was reached, an air lock was bolted to the top of the shaft, and the caisson was carried to ledge under air pressure, increased with the depth. In the deepest caissons, the pressure when ledge was reached exceeded 40 lb. At this pressure, the caisson crews worked only 1-hour shifts morning and afternoon.

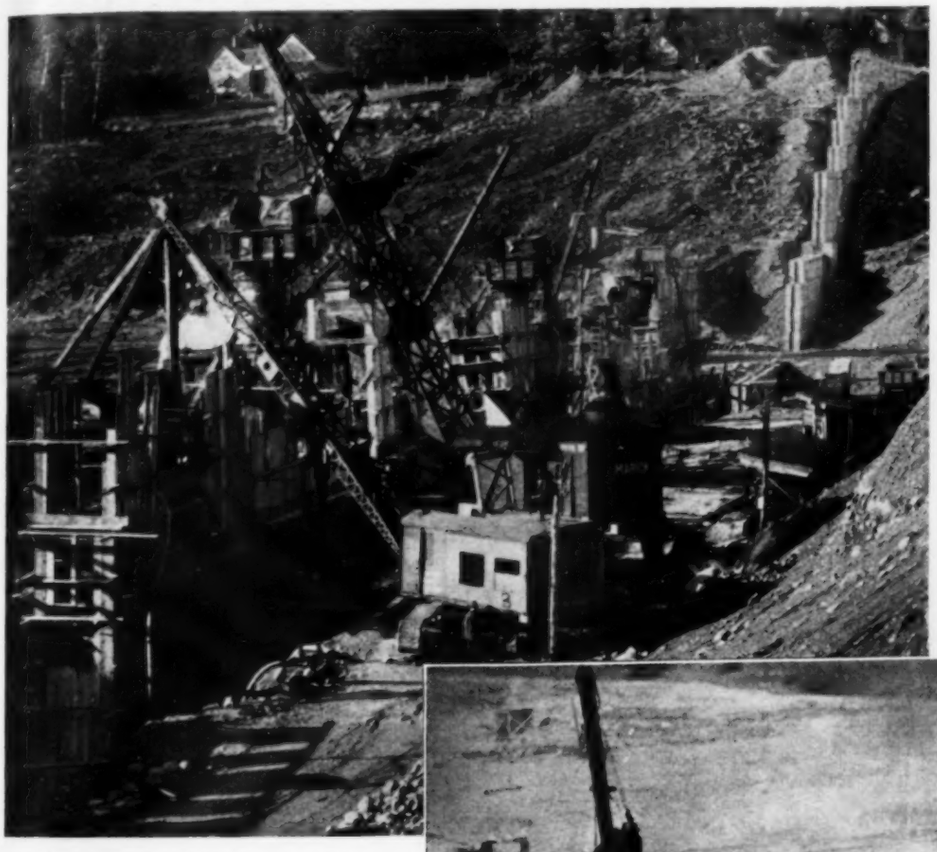
Because of the great number of large boulders, the skin friction was so great that the caissons could not be carried to ledge. In general, they were stopped from 10 ft. to 30 ft. above ledge. Underpinning walls approximately 20 in. thick then were installed under the cutting edge and were carried down in 3-ft. lifts until ledge was reached. After the ledge had been cleaned off, this entire space and working chamber and shaft were filled with concrete.

Concreting Joints—The 2-ft. joints between the main caisson blocks were closed by casting a concrete block, containing a 30-in. shaft, at the surface, and installing an air lock. Below the block, the joint was excavated and sheeted until ledge was reached. In the deepest pits, the wood sheeting was reinforced and sealed with a layer of concrete on the inside. As the final operation, concrete was placed through the air lock, filling the joint and completing the wall.

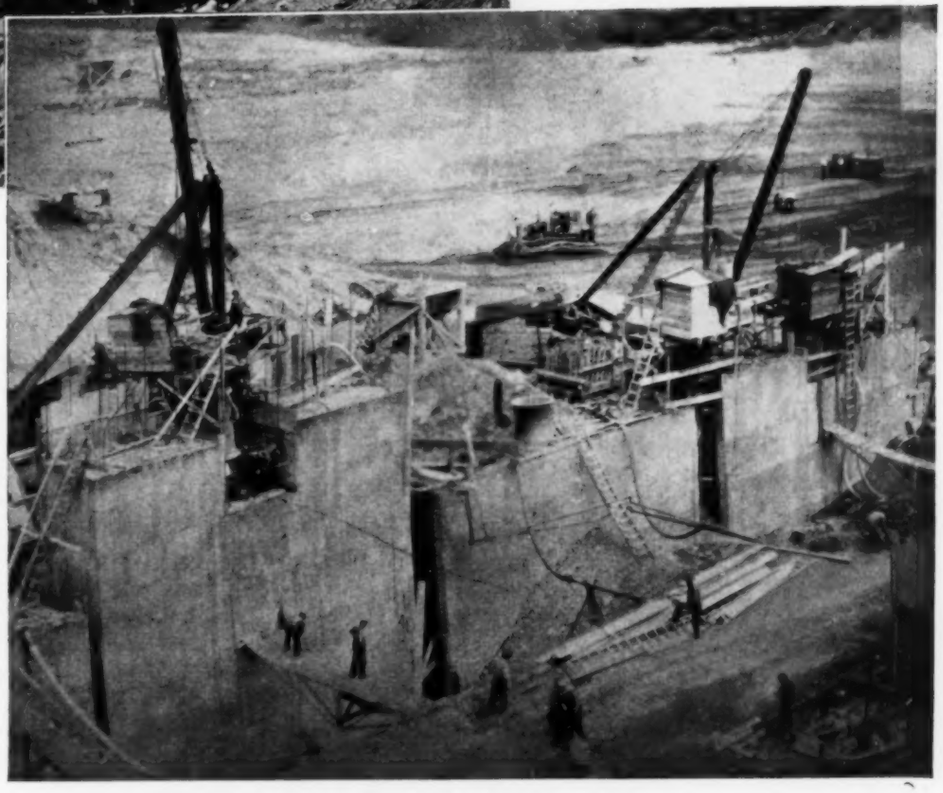
As this wall was a separate unit of the development and included practically all concrete on the east side of the river, its construction was planned independently of the much larger yardage of concrete and more extensive construction on the west bank. Concrete for the wall was mixed in a temporary plant located at the rail head on the high ground back of the dam. Sand and gravel were brought in by cars and unloaded by a crane which also fed the hoppers over the mixer. Concrete was transported to the wall by truck in bottom-dump buckets, and lifted to the caissons by one of the two cranes which were in constant attendance at the caisson line.

The caisson construction was carried out by the Foundation Co. of New York. The contract for the complete development is in the hands of Morton C. Tuttle Co. of Boston.

STARTING NEXT MONTH—A series of pictorial articles illustrating methods of construction on the New York City subway system.



CRANES handle bottom-dump concrete buckets into caisson forms.



JOINTS between caisson blocks are fitted with air locks and are excavated and concreted under pressure.

LOG LODGE

Built to Last

By HAROLD L. FURST
Construction Manager,
Lucerne-in-Quebec Community Assoc., Ltd.

THREE log buildings, comprising the largest group of this type ever erected, are now being completed at Lucerne - in - Quebec, the 80,000-acre recreation tract centering at Montebello, Quebec, by the Lucerne-in-Quebec Community Association, Limited. These buildings, comprising the new Log Lodge Hotel, garage and servants' quarters, have a content of 3,526,200 cu.ft.

The construction of log-type buildings has its special features of design to take care of stresses resulting principally from expansion and contraction of the logs.

Selection of Logs—The selection of logs depended on structural strength, appearance, workability, ability to be handled without damage, weight, and available supply. Western red cedar logs, conforming to the specifications of the Western Red Cedar Association, met all requirements. The structural strength of these logs was adequate. All of the walls are wall-bearing, and the only tension stresses are in the lintels of window and door heads.

The Association's specifications require that all logs shall be barked and free from cat faces, checks, etc., that the surface shall be smooth and regular, and that the individual logs shall not taper more than 1 in. in 10 ft. of length.

These specifications also provide that logs be seasoned at least one year, thus taking care of the workability requirement. A seasoned log is more easily worked, either with saw or axe, than a green log, and is much lighter in weight. As western red cedar logs are the standard for telephone poles, a sufficient quantity of seasoned timber was readily available.

Construction—The general wall design consisted of bays with vertical posts 28 ft. 11 in. on centers and 23 ft. high from sill to plate. The vertical posts, of 11-in. average diameter,

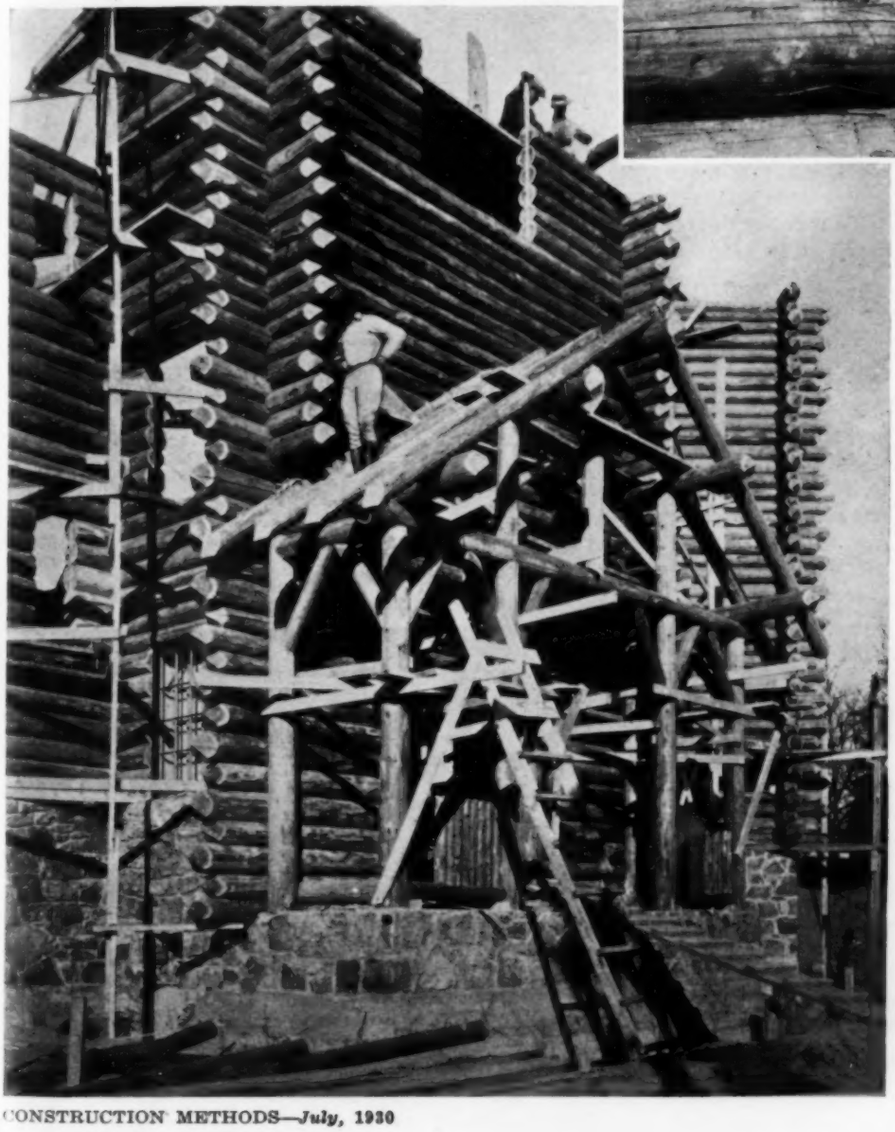
CALKING with oakum between horizontal logs as they are put in position.

LOGS FOR SLABBING MILL are unloaded on to skids where they remain until scheduled for milling. Vertical posts are slabbed on sides where horizontal logs meet them.

Three Buildings of Quebec Community Designed for Low Maintenance and Long Life

were slabbed on the sides where the horizontal logs met them, having a flat surface of approximately 7 in. For the horizontal construction, the builders determined to use logs having an average diameter of 9 in.

The vertical logs were cut to size on the ground. On the two flat surfaces a 2x3-in. strip was nailed to form the tongue of a tongue-and-groove joint, the groove being cut in the end of the log to receive the connection, as illustrated by one of the drawings. Two vertical posts were erected and braced sufficiently to allow the placing of the horizontal logs. Two men, working on the bay, sawed a horizontal log to length and drilled it with a ship's auger of approximately 2-in. diameter, the center of the hole being spaced about 2 in. from the end

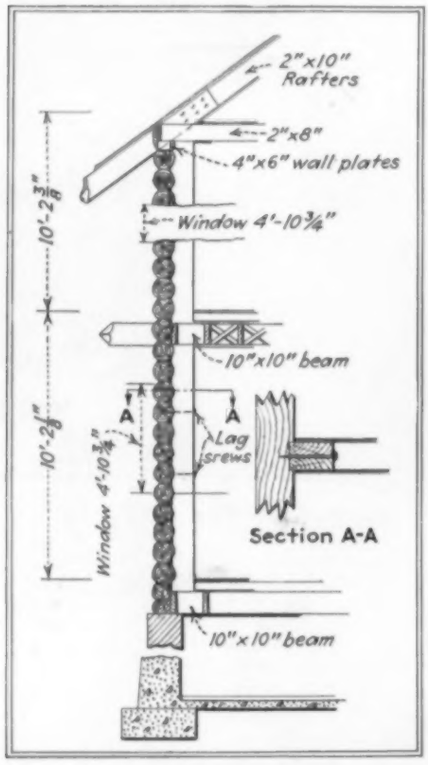


HEAVY WOOD DOWELS bind logs together. Workman is driving dowel through hole drilled halfway into lower log. AT CORNERS *(left)* where no post occurs, logs are notched to fit over logs below, providing picturesque design and strong construction.

of the log. After the hole was drilled, the logman took his axe and cut out the remaining wood between the hole and the end of the log, forming a groove to fit the strip already provided on the side of the post. After both ends had been slotted, one man working on each end, the first log was put in place. Before the second log was laid, the top of the first log was ax-marked to provide a rough surface on which a layer of oakum was placed, providing a good calking base for the oakum packed between the two logs. Logs were laid with butts and tips alternating to provide an evenly built wall. After the second log was in place, a 2-in. hole was drilled approximately 3 ft. from each end through the second log and about halfway through the first log. Heavy wood dowels were driven home to bind the logs together.

In addition to the oakum packed between horizontal logs and between horizontal logs and posts, provision was made to calk all exterior joints, both

LOG LODGE rises rapidly above concrete and stone foundations. More than 8,000 red cedar logs go into construction of walls. Vertical posts are spaced 28 ft. 11 in., c. to c. Horizontal logs are connected to them by tongue-and-groove joint.



CROSS-SECTION OF WALL. Intermediate post of skeleton frame supports both second floor beam and horizontal logs at center of bay. Lag screws (Section A-A) go through slot in post into all horizontal logs.

between logs and around window and door openings, with a special form of plastic cement tested for this use.

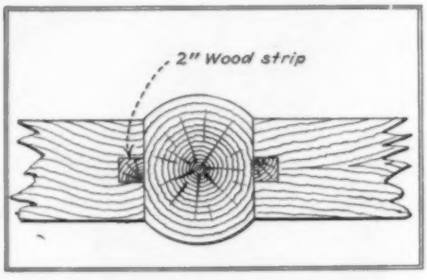
Provision for Expansion and Contraction—No matter how carefully logs are selected, considerable expansion and contraction is bound to occur during the first two years after erection. A log 9 in. in diameter may expand and contract $\frac{1}{8}$ in. to $\frac{3}{16}$ in. within a short time.

It is impractical to erect logs in bays 20 ft. in length without providing some center support to prevent bowing. To take care of the 28 ft. 10-in. bays of this structure, the skeleton frame was designed with an intermediate post in the center of the typical bay. These posts, 6x10 in. in size, support the second floor beams.

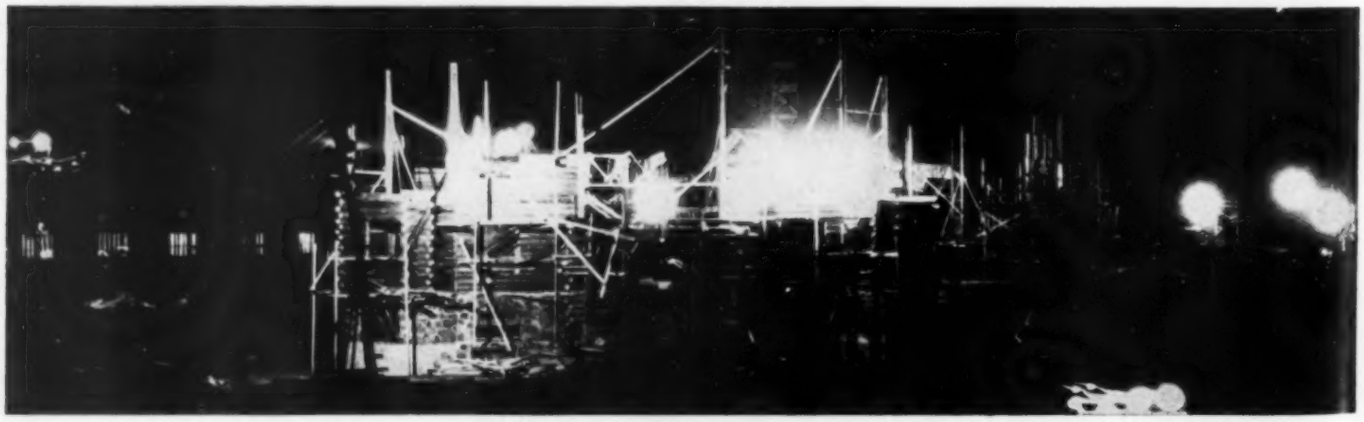
To support the center of the logs, a slot was provided in the 6x10-in post of the skeleton frame, and lag screws $\frac{3}{8}$ in. in diameter and 14 in. long, with adequate washers, were put through the slots and screwed into each horizontal log. The logs thus can work free of the superstructure of the building, and no stresses will be set up that will cause harm to the building and to floor levels. Over the head of each window and door on the first and second floors, a notch was cut in the logs about $1\frac{1}{2}$ in. above the top of the frame to allow for expansion and contraction and to avoid damage to the window frames and sash.

The actual construction of the Log Lodge, garage and servants' quarters started on February 22, and the completion date of these three buildings was set for July 1. To meet this schedule a crew of 170 loggers was developed, and the erection of logs was carried on day and night.

The Log Lodge has 180 rooms, each with bath, fifteen three-room suites and one two-room suite. The garage accommodates 200 cars, and the servants' quarters provide for 160 people.



TONGUE-AND-GROOVE JOINT between vertical post and horizontal logs. Tongue is formed by 2x3-in. wood strip nailed to flat surface of post.



FLOOD LIGHTS illuminate job at night, allowing 24-hour operation. Total of almost 800 men rush hotel and other buildings to completion for summer business.

SHUTTLE LOADER FOR CARS

Reduces Segregation of Crushed Stone

By W. H. MILLS
Testing Engineer,
South Carolina State Highway Dept.

LOADING DEVICE *(left)* discharges through two openings, building two piles of stone as it travels back and forth across car.

A DEVICE which greatly reduces the segregation of crushed stone in loading cars from overhead storage bins recently was developed and placed in service by the Weston & Brooker Company, quarry operators of Columbia, S. C. The usual method of loading puts a wedge of fine material down the center of the car, while the coarse stone concentrates along the sides. It was possible to avoid segregation at the loading bins by shuttling the cars back and forth under the loading chute, having at the same time an arrangement to distribute the stone evenly across the car, but this method was found to be impracticable. The device recently adopted was designed to obtain approximately the same results.

Design of Loader—The device consists essentially of two steel boxes suspended one under the other from a four-wheel carriage that travels on an overhead runway at right angles to the loading track and under the loading chute of the storage bin. The upper box is 6½ ft. long, 4½ ft. wide and 2¼ ft. deep, with an open top. In the bottom of this box two 14-in. square holes were cut 30 in. apart on the transverse center line. Swung symmetrically under this center line is the second steel box, 6 ft. long, 2 ft. wide and 1¼ ft. deep. The bottom of this lower box also has holes corresponding to those in the upper one.

The entire carriage with the boxes travels back and forth across the car at a speed of about 1 ft. per second. The distance traveled is approximately 5 ft., and the speed was fixed after some experimenting so that the stone would not pile up at the end positions.

The carriage is shunted by an Ingersoll-Rand type DU compressed-air motor with an attachment developed on this job which instantaneously reverses the movement of the carriage. Electric drive was not used because of the time required to stop and reverse.

Operation—In operation, one end of the railroad car is spotted directly under the loading device. The carriage then is started and shuttles back and forth, forming two piles in which the fine material is evenly distributed across the car. When these piles have built up to about half the depth of the car, the car is shifted until the stream from the rear hole in the lower box falls into the valley between the first two piles. When this portion of the car is filled, it is shifted about 5 ft. In the new position one stream of stone hits approximately at the bottom of the last pile and the other hits about half way up on that pile.

By using this device the quarry company has been able to put more fine particles in its shipments, as the fine material is so much more evenly distributed through the mass. Samples taken from the car after loading are much more uniformly graded than in the old way of loading. They also check closely with those taken from the loading chute.

W. S. Weston, mechanical engineer for the Weston & Brooker Company, designed the loading device and worked out the drive used in propelling it.

MOVING LOADER shuttles back and forth above car, distributing coarse and fine stone evenly. Automatic attachment on air motor reverses direction of movement instantly.

Railroad Construction in Mountain Country—III

Modern Machines and Methods Speed Building of 28-Mile Link in West Virginia

By VINCENT B. SMITH
Assistant Editor, Construction Methods

DIFFICULTIES of importing and operating construction equipment in remote canyons of mountainous West Virginia have failed to delay the builders of a 28.1-mile link of the Nicholas, Fayette and Greenbrier Railroad. General conditions surrounding the project and methods employed in grading, bridge building, and driving one tunnel were illustrated and described in the last two issues of *Construction Methods*. This concluding installment contains further examples of tunnel construction and grading operations.

Brown, Murphy & Wright Section—Brown, Murphy & Wright had to contend with a large proportion of loose rock and earth, only 20 per cent of their excavation being solid rock. During the weeks of wet weather in the winter, it was necessary to pave the cuts and fills with rock and planks to make them passable for trucks. Total excavation on the 3¼ miles of this section amounted to approximately 258,000 yd.

The contractors carried on the excavation with a Lorain 1¼-yd. gasoline shovel and a Bucyrus-Erie 1-yd. steam shovel. Three Ingersoll-Rand portable compressors provided all the air necessary for drilling. The hauling equipment consisted of three Hug 5¼-ton trucks equipped with Wood hydraulic hoists, three Hug 3½-ton hand dump trucks, and six teams and dump wagons. To reach the job, the shovels, after traveling down a 30 per cent grade for 1 mile from the plateau above the canyon had to force their way for 800 ft. down a 30 per cent slope through virgin forest.

Dempster Construction Co. Sub-Contract Section—The most interesting feature of construction on the Dempster Co.'s 1-mile section is the 900-ft. Carnifex tunnel. This tunnel is on a 6-deg. curve and a grade of 2 per cent, compensated. The rock is a hard gray sandstone. A top heading was driven to grade of springing line from both portals. All bench muck was removed from the north portal. Timber lining was placed for about 400 ft. inside the tunnel to avert danger of rock falls, sets of 12x12-in. oak timbers being spaced 6 ft. apart in these portions. The entire tunnel was lined with an 18-in. minimum thickness of concrete.

Driving Heading of Tunnel No. 2—Six Sullivan water-liner drifter drills, T-3 and DW-64 types, on column mountings, were used in the heading, most of which was driven from the north portal. For part of the heading, drill steel 12 ft. long was used to pull 10-ft. rounds; but, for most of the drilling, 8-ft. steel was employed to pull 6 ft. at a round. Each round consisted of 28 to 32 holes, fired with three delays.

Driving of the heading was started at the north portal, where the contractor installed a steam-driven air com-

NORTH HEADING of Carnifex tunnel. Crown heading is driven to grade of springing line from both portals. Rock is hard sandstone.

TIMBER EXTENSION *(right)* of tunnel at north portal protects entrance from slides on steep earth slopes above. Twelve timber sets form shed extending 40 ft. beyond rock portal. All bench muck is removed from this portal. Full tunnel section then is constructed inside timbers and is backfilled.

DIESEL SHOVEL, with 2-yd. dipper and especially long boom, loads railway cars on bank of 1,500-ft. rock cut, of 40-ft. maximum depth, on general contractor's grading section.

pressor of 400-cu.ft. capacity, with a 30-hp. boiler, to supply the drills until a large 750-cu.ft. compressor, with a 150-hp. steam boiler, had been placed in operation on top of the mountain to furnish air to both portals. Heading muck was shoveled by hand into small cars which were hauled to the dump by mules.

The same arrangement of three rows of down holes and two rows of horizontal lifter holes, as used in the Koontz Bend tunnel, was adopted for shooting the bench of the Carnifex tunnel. An air-operated Marion '25 shovel loaded the bench muck into 4-yd. cars, which were hauled by 12-ton steam dinkeys.

A. Guthrie & Co., Inc., Grading Section—Excavation on the 2.3 miles which the general contractor graded below Shawver's Bridge amounted to more than 225,000 yd., of which 60 per cent was solid rock and 20 per cent was loose rock. A through cut, 40 ft. deep and 1,500 ft. long, and contemplated hauls up to a mile in length eliminated the possibility of using trucks. The contractor, therefore, equipped it with narrow-gage railway equipment including three Whitcomb 20-ton dinkeys, one diesel and two gasoline, and 32 Western dump cars, six of 6-yd. capacity and 26 of 4-yd. size. The excavators were a Link-Belt 2-yd. 75-ton diesel shovel, with a boom of extra length for high loading in the through cut, and a Link-Belt 1-yd. diesel shovel.

Approximately 75 per cent of the excavation was side-hill cut. All spoil had to be hauled except about 25,000 yd., which was wasted. Three large fills on the section took 175,000 yd. of the spoil. Because fills were on better ground and material swell was more than expected, hauls from the cuts

CRUSHING PLANT reduces hard local sandstone to make fine and coarse aggregate for concrete in arch culvert. Because of remote location of work, crushing plants are used to produce aggregates at sites of all concrete structures.

were shortened until there were few more than 1,000 ft. long.

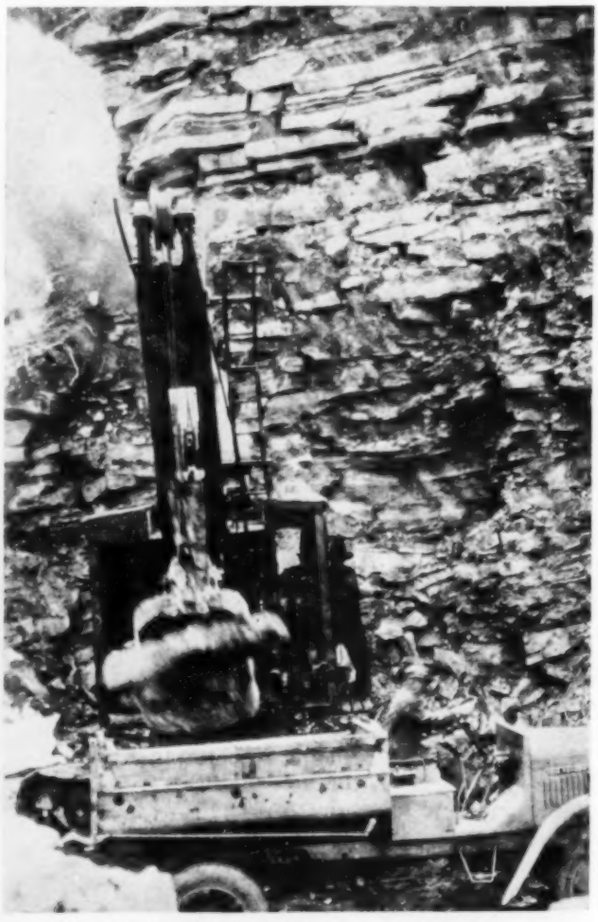
In cutting the faces of cliffs on this section, Fred Miller, superintendent, used the coyote-hole method previously mentioned in the description of the quarry blast at Peter's Creek. According to C. M. Faulkner, superintendent for A. Guthrie & Co., Inc., of all construction on the Nicholas, Fayette and Greenbrier Railroad, Mr. Miller, by this method, breaks as much as 3 yd. of rock for each pound of explosive used. In making one cut along the face of a cliff, the cut being 400 ft. long and 100 ft. high above the ditch line, Mr. Miller drifted eight horizontal holes at grade, 41 to 67 ft. long, to the cut line, and drove tees 12 to 14 ft. long at the end of each hole. Additional crosscuts of the same length were driven midway in each drift. The eight holes were loaded with 28,000 lb. of Atlas 40 per cent glycerin Judson powder and were fired simultaneously, breaking 80,000 yd. of rock, slightly less than 3 yd. per pound.

In cutting the face of another cliff, the cut being approximately 200 ft. long and 58 ft. high on the center line, Mr. Miller, to save time and labor in driving the coyote holes, opened the holes through a coal seam 30 ft. below grade. Four drifts were opened and loaded with a total of 14 tons of Judson powder. This charge broke about 30,000 yd. of rock, of which 20,000 yd. above grade was removed.

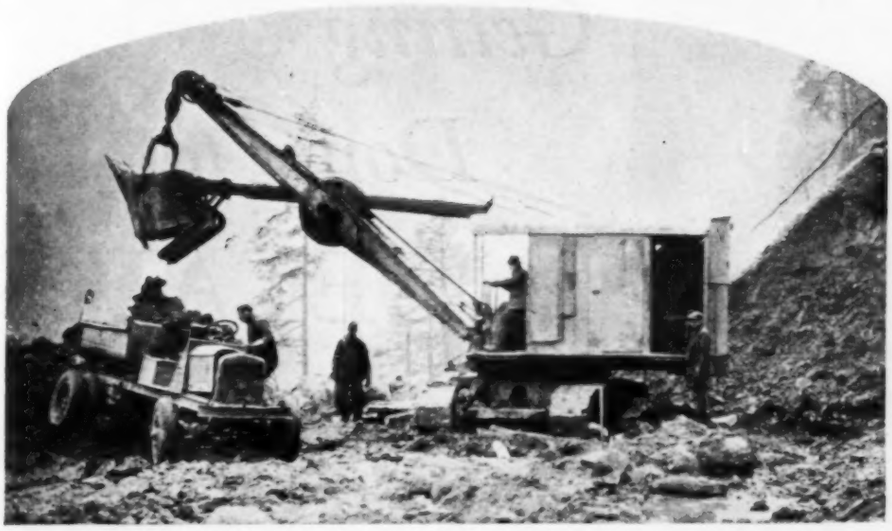
TRACTOR DUMP CARTS AND TRUCKS move spoil on Poston, Brewer & Brewer section, where hauls are comparatively short.

Poston, Brewer & Brewer Sub-Contract Section—Grading on this 7.3-mile section from Shawver's Bridge to Nallen was comparatively light, amounting to approximately 25,000 yd. per mile. Approximately 60 per cent of the excavation was solid rock. One of the most difficult features of the grading was the presence of numerous large boulders, some of them containing hundreds of cubic yards, on the right-of-way. These boulders had to be drilled with jackhammers and shot

BOULDERS containing hundreds of cubic yards obstruct right-of-way on Poston, Brewer & Brewer section. Man on ground is on center line of survey



LAMINATED SANDSTONE in horizontal layers is most common rock formation. Steam shovel loads truck for Brown, Murphy & Wright.



TRUCK HAULING is economical on Brown, Murphy & Wright section, characterized by side-hill cuts and short hauls. Gasoline shovel is loading soft material typical of this section.

in sections, at the expense of much time and labor.

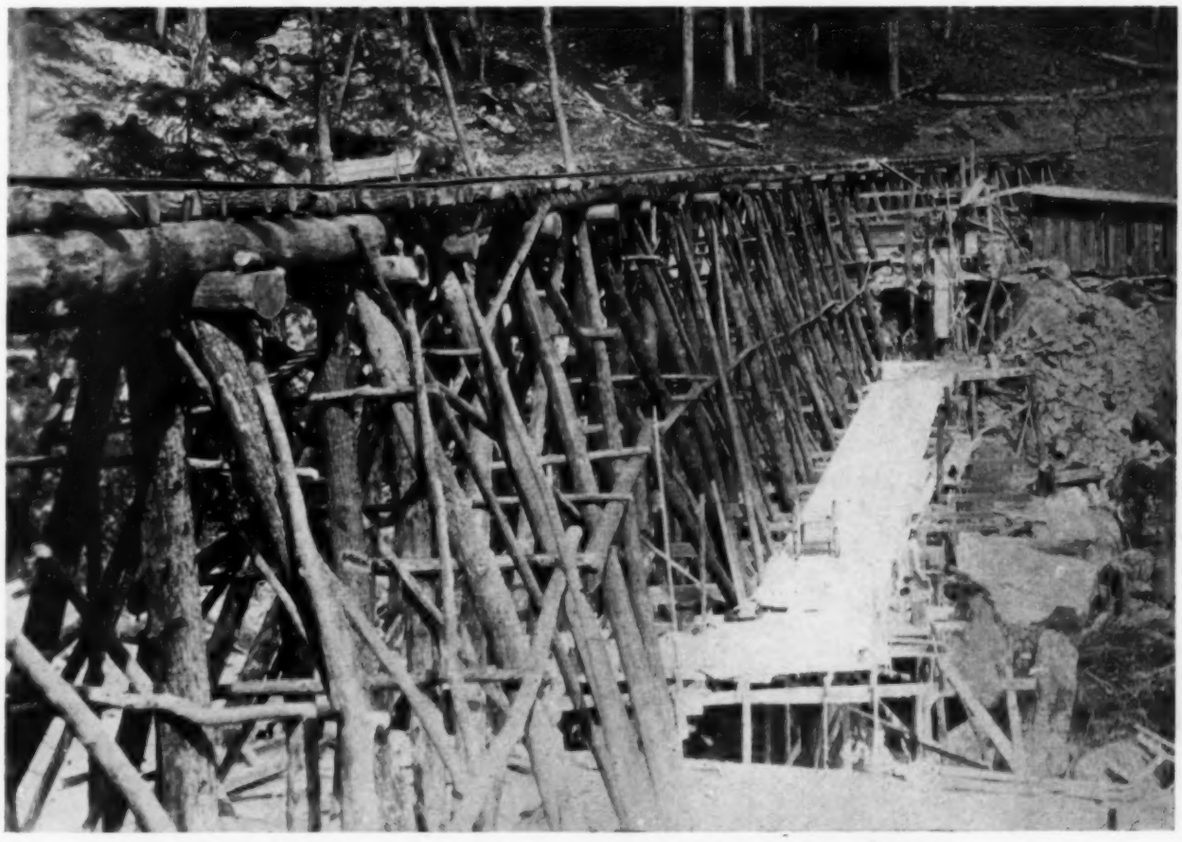
The contractors needed many compressors to operate the drills on boulders and solid rock over the 7.3 miles of this section. They used three Buhl compressors, one of 220-cu.ft. capacity, and two of 110-cu.ft. capacity, one 100-cu.ft. Chicago Pneumatic compressor, and one 100-cu.ft. Schramm machine. All drill steel was sharpened by one Ingersoll-Rand drill sharpener. For hauling excavated material, the contractors had eight 2-yd. Iron Mules, two 4-yd. Iron Mules (mounted on crawlers), and four 5-ton Hug trucks. To haul equipment and supplies over the lumber company's narrow-gage railroad from Nallen, Lon Hawk, superintendent, rented a Brookville gasoline locomotive.

Excavation was handled by three Osgood steam shovels, two having ¾-yd. dippers, and one, a 1-yd. dipper. The contractors shipped the shovels to the job by way of Nallen.

Working Force—The total working force of all contractors on the N. F. & G., when operating at the maximum, was between 500 and 600 men.

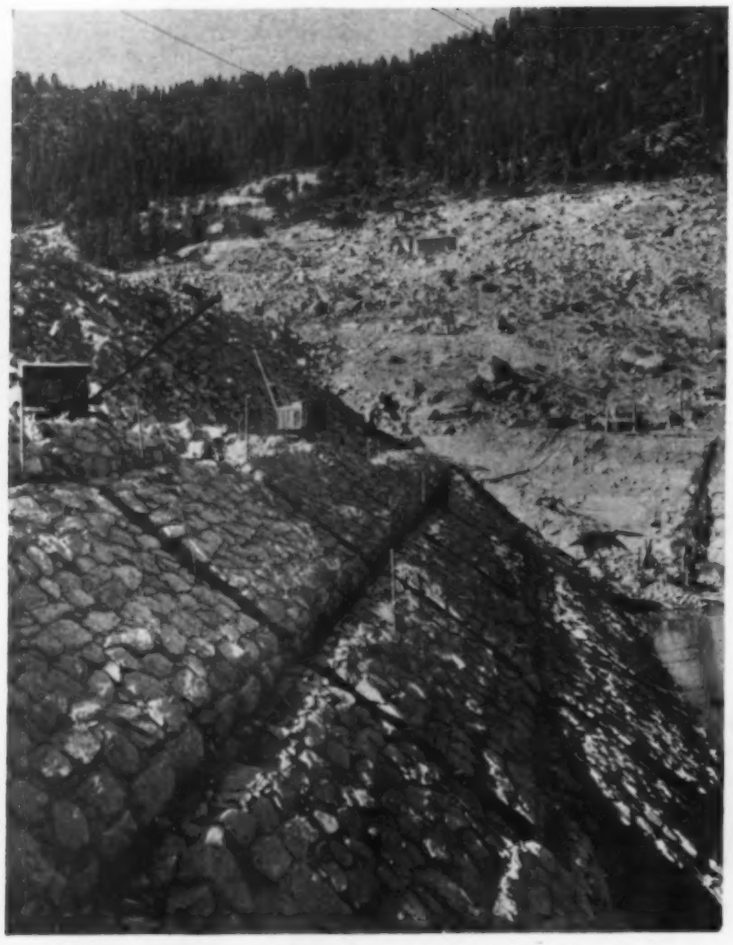
Personnel—As mentioned before, construction is under the supervision of J. A. Stocker, chief engineer, Ohio Central Lines of the New York Central, Columbus, Ohio, with C. M. McVay, engineer of construction, and G. L. Link, assistant engineer of construction, Charleston, W. Va., in immediate charge of operations. The resident engineers are G. S. Plumley, J. E. Hammond, and W. H. Eary. The superintendent in charge of the entire project for the general contractor, A. Guthrie and Co., Inc., is C. M. Faulkner. In general charge for A. Guthrie & Co., Inc., are J. C. Baxter, vice-president, New York City, and W. E. Conroy, general superintendent, Cleveland, Ohio.

NEXT MONTH: An amply illustrated article on construction of another mountain railroad.

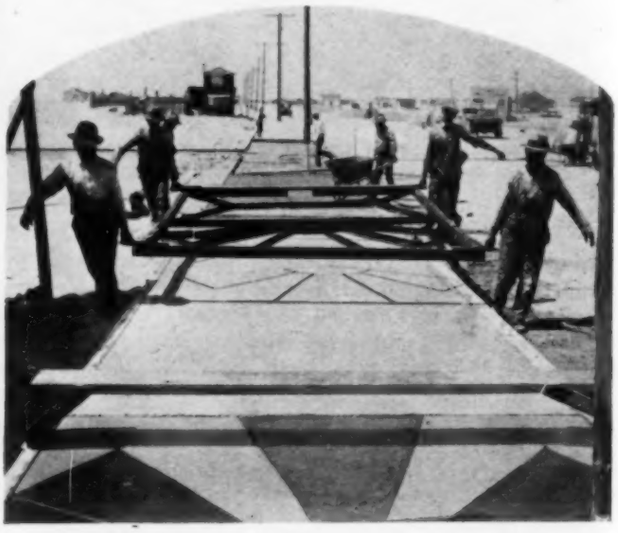


DUMP TRESTLE on general contractor's section is erected to make 43,000-yd. fill over concrete culvert. Similar trestles are used for two other fills on this section. Concrete for culvert is distributed by buggies moving over runway.

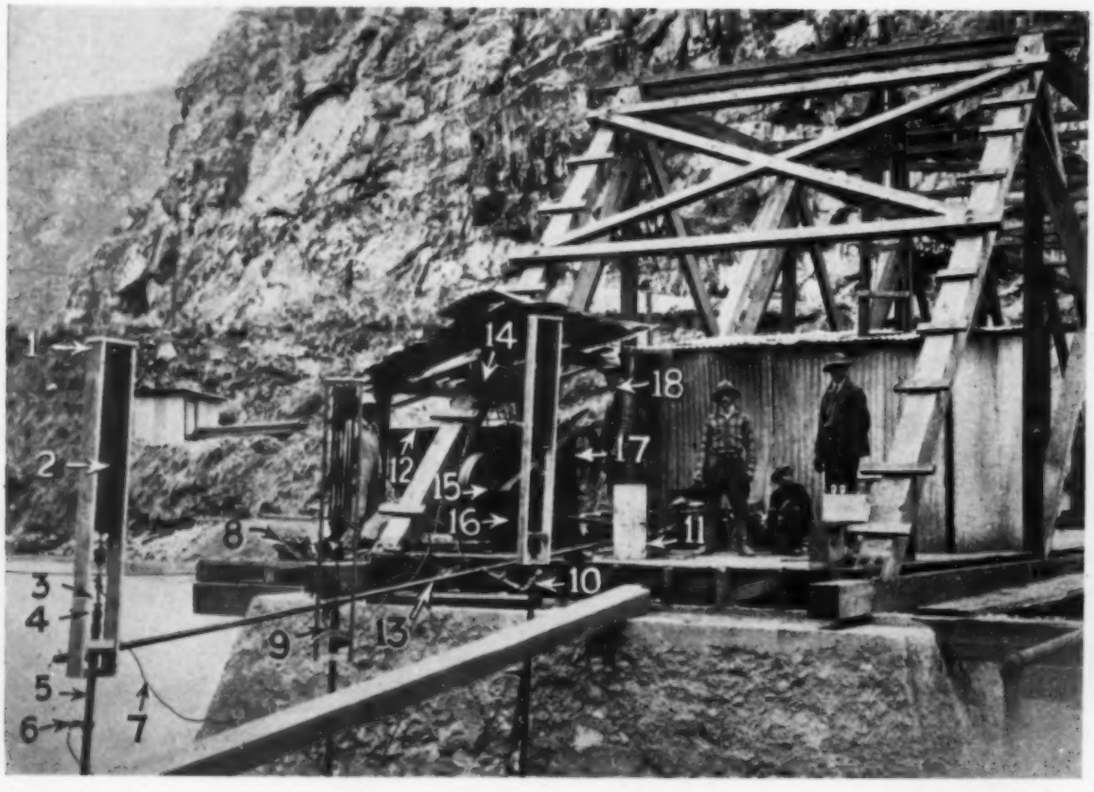
Getting Down to DETAILS



DERRICK-PLACED PANELS of granite facing, 15 ft. thick, ready for covering by reinforced concrete slab, to protect upstream face of 328-ft. high Salt Springs rock-fill dam on Mokelumne River in California. Concrete beams are poured in grooves shown separating the 60x60-ft. panels.



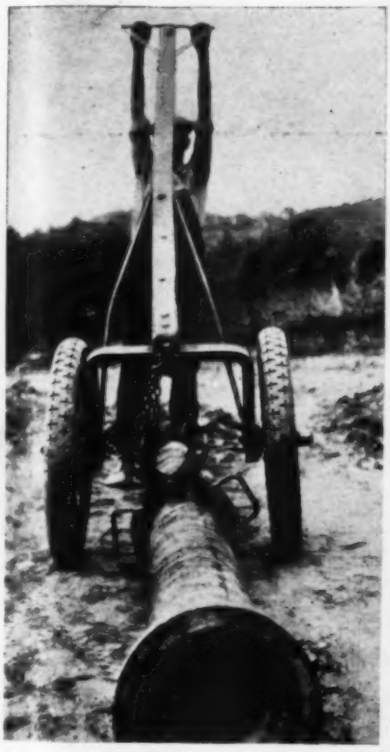
MULTI-COLORED CONCRETE SIDEWALKS in elaborate designs are built at Silver Strand Beach, California, by Fleming Construction Co., with aid of welded steel forms. Base course is 3½-in. dry mix concrete with ¼-in. finishing coat of colored 1:2 cement mortar.



HOT ASPHALT GROUTING *(left)* seals gravel and boulder foundation 140 ft. deep for dam in South America. Details of electrically heated pipe line set-up by American Asphalt Grouting Co., of Chattanooga, Tenn., are: (1) Head fittings. (2) Tension springs. (3) Hot wire. (4) Stuffing box. (5) Electrically heated pipe line, lower portion perforated. (6) and (7) Electrical connections. (8) Asphalt. (9), (10) and (11) Other holes ready for grouting. (12) Melting kettle. (13) Electrically heated supply pipe. (14) Transformers to adjust current to heat pipe line. (15) Counter shaft. (16) Motor. (17) Asphalt pump. (18) Operator.

Close-up Shots of Job Methods and Equipment

BOOM DITCHER, a Barber-Greene unit, excavating 18-in. wide trench to 5-ft. depth, tows a crawler-mounted cable-laying reel for the Indiana Bell Telephone Co. Progress in ditching and cable-laying is reported as from 1,750 to 2,000 ft. per 8-hour day.

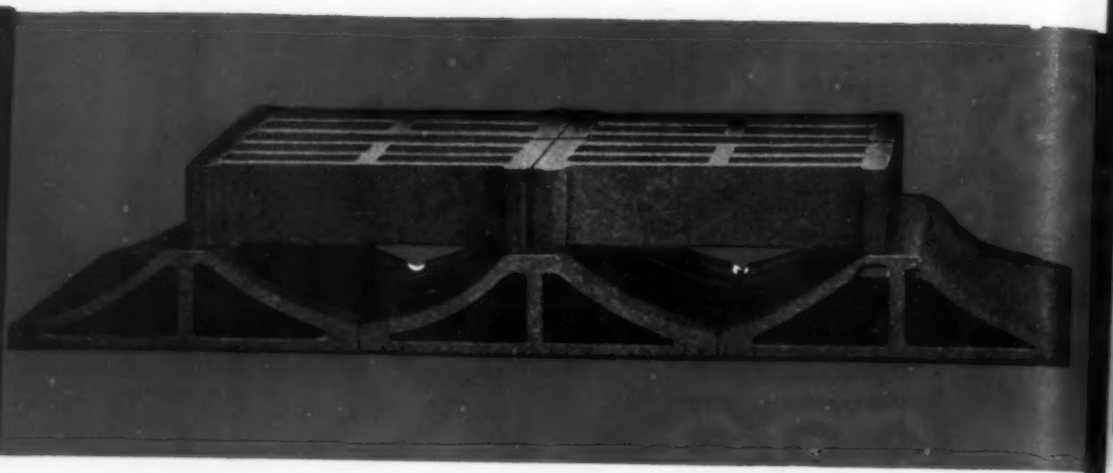


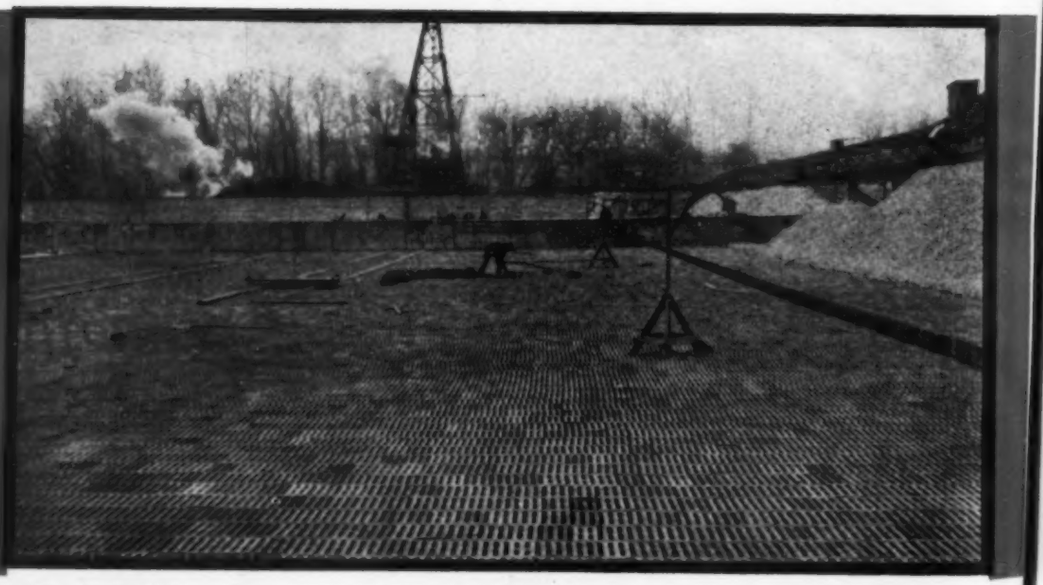
PIPE-HANDLING CART and grapple, with handles, is used by the Huntington (W. Va.) Water Corporation.

CRAWLER MOUNTING for a blade grader. Caterpillar tractor hauls novel outfit made by Creeper Wheel Co. of Reading, Pa., for road work over soft, marshy ground in Sussex County, Del.

STIFFBACK allows Merritt-Chapman & Scott Corp. to handle as unit four lengths of United States cast-iron pipe, 60 in. in diameter, for deep-sea sewer outfall at Lynn, Mass.

BENT BY BUCKET. Steel reinforcement for buildings of Cooksville Co. in Canada, is shaped by jaws of clamshell on Link-Belt crane.





Showing Grill Block over channels and stone being placed.
Sewage Treatment Works, Akron, O.
Metcalf and Eddy—Consulting Engineers.
Walsh Construction Co.—Contractors.

The Metropolitan P

Easy to Lay
Lasts Indefinitely
"METRO"
FILTER FLOORING

THE "Metro" Filter Flooring consists of a channel and grill block—two pieces easy to handle—simple to lay. The contractors' work is simplified as the channel forms the under drain and eliminates any necessity for shaping concrete floor. The grill block is also light in weight and can be handled by one man. A feature which means economy for the contractor.

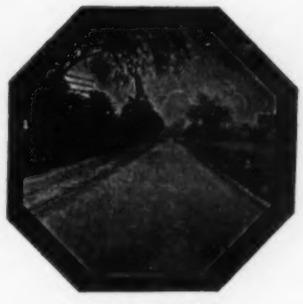
"Metro" is the original Vitrified Filter Flooring and is not affected by action of sewage. There's no wear-out to this floor.

The grill is so designed as to give thorough aeration and drainage and has ample strength to hold any load imposed upon it. The channel can easily be flushed and affords an ideal under drain.

If you haven't received complete details, write for booklet.

Face Brick

Structural Tile



Paving Brick

Paving Brick Co., CANTON, OHIO

Step-by-Step

Applying TERRAZZO Pedestrian Area

AS PART of its program for beautifying Canal Street, the City of New Orleans recently completed 6,000 lin.ft. of colored terrazzo-finish sidewalk with an aggregate width of nearly 80 ft. The area improved includes two 21-ft. sidewalks between building line and curb and a 58½-ft. section in and between the lines of street car tracks which occupy the so-called neutral ground between the two vehicular roadways.

As illustrated by the photographs, a 1-in. top coat in two colors—red and white—with terrazzo finish,

1 WHILE STILL FRESH, concrete of 4-in. base is marked into diamonds by small trowel run along straight-edge.

2 THIN BRASS STRIPS *(in oval)* are set in these marks before concrete hardens. Along curbs and street car rails, strips form rectangles instead of diamonds.

3 RED CONCRETE, colored with 8 lb. of red iron oxide per 100 lb. of cement, is put into rectangular sections to form border.

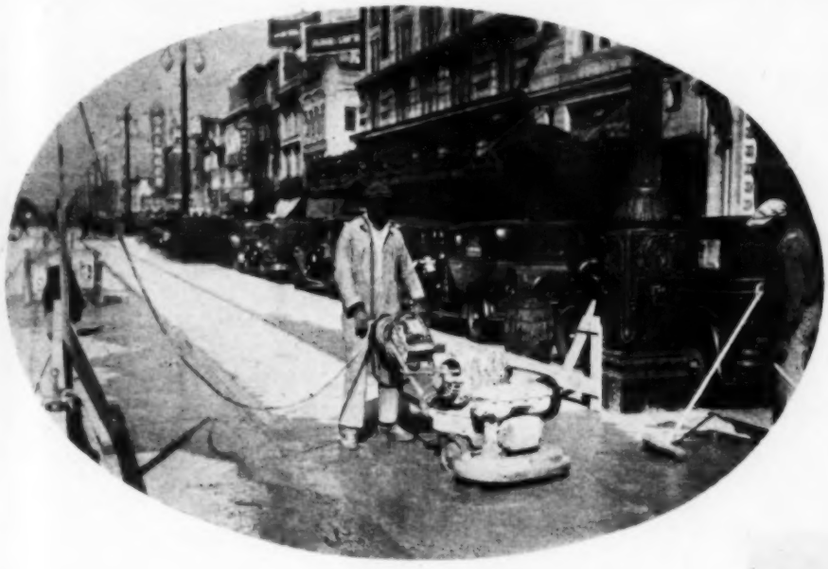
4 BETWEEN BORDERS, 1-in. top coating consists of uncolored 1:2 concrete containing large percentage of white stone chips. Additional white stone chips are scattered over uncolored top and red stone chips over red borders.

FINISH to Extensive in New Orleans

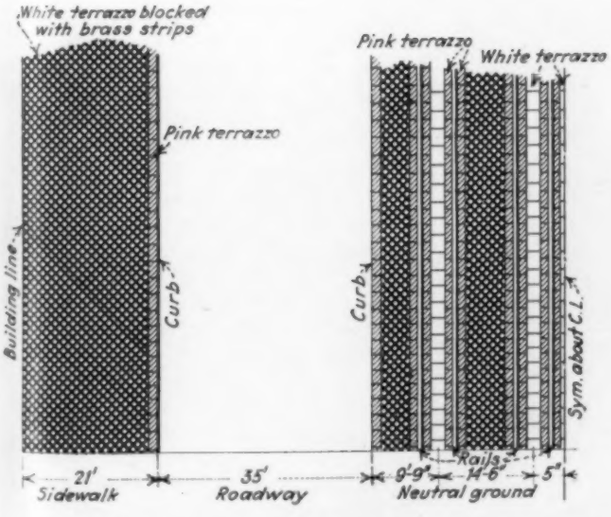
was placed on a 4-in. base of 1:3:6 concrete. The white walk cost $5.65 and the red portion $5.95 per square yard.

To prevent cracking of this pavement by loads transmitted from the car tracks, a novel foundation for the rails was developed by the New Orleans Public Service, Inc. The rails rest on resilient diaphragm anchorages concreted into a foundation mat shaped to form a continuous girder beneath each rail. This foundation mat takes the place of the usual crossties. Diaphragms are spaced on 4-ft. centers, staggered to minimize foundation stresses.

5 **LIGHT HAND ROLLER impresses scattered stone chips into surface of top coat.**

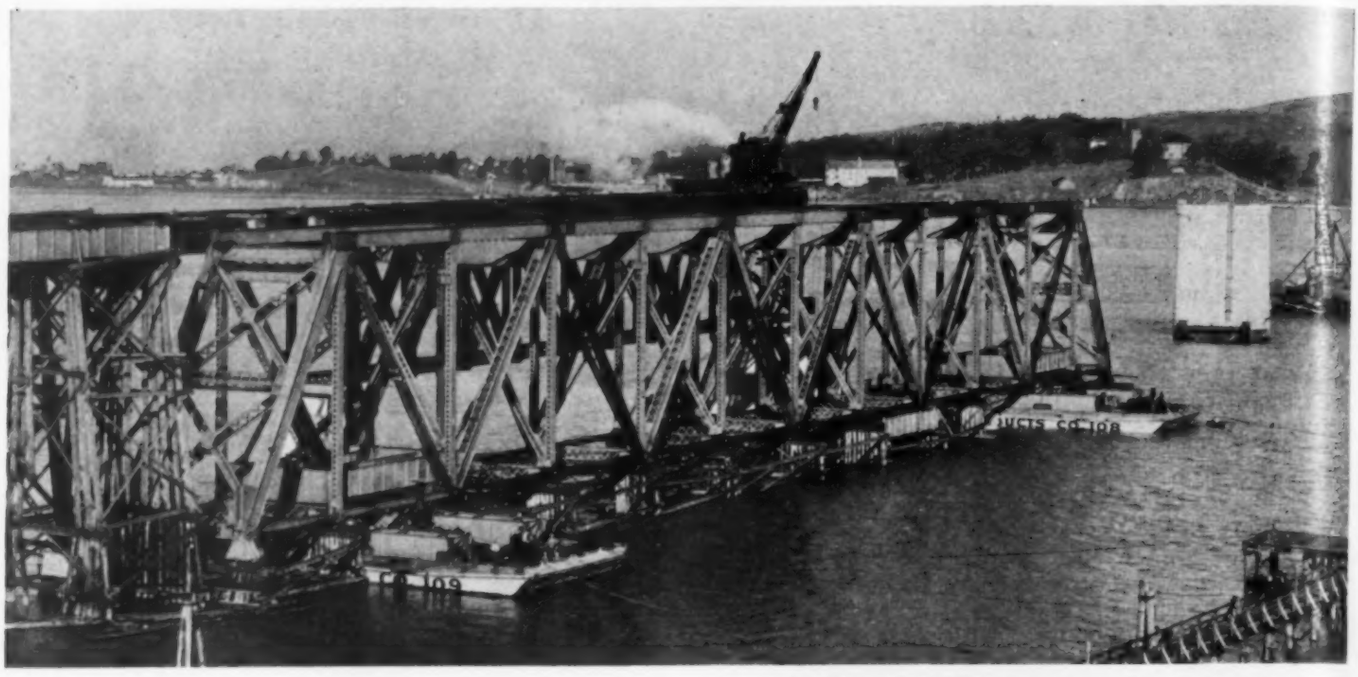


6 **TO GIVE TERRAZZO FINISH, electric grinding machine *(in oval)* exposes stone chips by grinding off surface mortar.**



SIDEWALKS AND NEUTRAL GROUND of Canal Street, aggregating almost 80 ft. of total width of 170½ ft., receive terrazzo finish in two colors. Brass strips separate surface into rectangular and diamond-shaped panels.

7 **ATTRACTIVE WHITE AREAS, relieved by red stripes, beautify New Orleans' main street, after completion of improvement.**



DECK-TRUSS SPAN, erected on piles at one end of bridge, will serve as falsework for seven through-truss spans. Bracket to be seen above water line on pier at right will support one end of deck truss during erection of first through truss.

Deck-Truss Span

SERVES AS FALSEWORK

for Seven Through-Truss Spans of Suisun Bay Bridge

TWO BARGES lift deck truss on rising tide and float it to position between two piers, lowering it on to brackets on falling tide.

A DECK-TRUSS span of the Southern Pacific double-track railroad bridge across Suisun Bay, Calif., is serving as falsework for the erection of seven through-truss spans. The American Bridge Co., steel erector, fabricated the deck-truss span on piles and, after floating it to position between two piers of a through-truss span, lowered it on to projecting brackets of the piers. In this position the deck truss supported the through-truss steel during erection.

The north approach span of the bridge is a deck truss 506½ ft. in length, c. to c. of piers. Two of the seven through-truss spans are 529½ ft., and the rest are 531 ft., c. to c. of piers. The 1,800-ton north approach truss was erected on falsework piles at the south end of the bridge.

Two steel barges of 1,000 tons lifting capacity each, placed under the ends of the span, lifted it off the piling on a rising tide. By means of winches on the barges operating lines attached to anchors, the span was maneuvered to position between the two nearest piers in 6 hours. The lowering tide seated the truss on supports carried by projecting shoulders of the piers. After erection of the through truss on the deck-truss falsework, the deck truss was moved ahead to the adjacent span. This process is to continue toward the north end until the deck truss reaches its own permanent position.

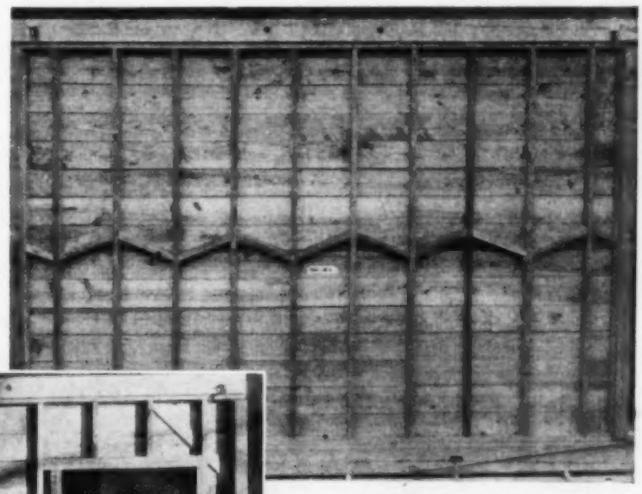
Diagonal Bracing, Let Into Studs, *Stiffens Horizontally Sheathed Wood-Frame Walls*

TESTS conducted by the U. S. Forest Products Laboratory, Madison, Wis., in co-operation with the National Lumber Manufacturers' Association, give valuable information regarding the relative resistance of frame wall panels to longitudinal thrust. This longitudinal stiffness is of greatest importance in determining a house's wind resistance and ability to maintain proper alignment.

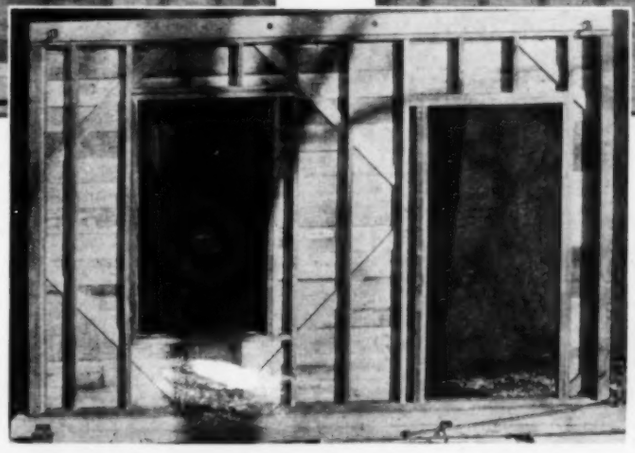
Diagonal sheathing with two nails at each stud crossing was found to be two to four times as rigid as horizontal sheathing similarly nailed. It is good practice, therefore, to use bracing in horizontally sheathed walls.

So-called herringbone bridging contributed very little (30 per cent) to the stiffness of a horizontally sheathed panel. Diagonal braces, 2x4 in., cut in between the studs, added about 50 per cent to the stiffness of the panel; but 1x4-in. diagonal braces let into the outside of the studs, increased the resistance to longitudinal pressure 150 to 300 per cent. Panels with door and window openings were less improved by this bracing than full panels; but let-in braces still proved by far the most advantageous. Wood lath and plaster give more rigidity than sheathing and bracing.

DIAGONAL BRACING, let into outside of studs, greatly increases resistance of horizontally sheathed panel to longitudinal pressure.



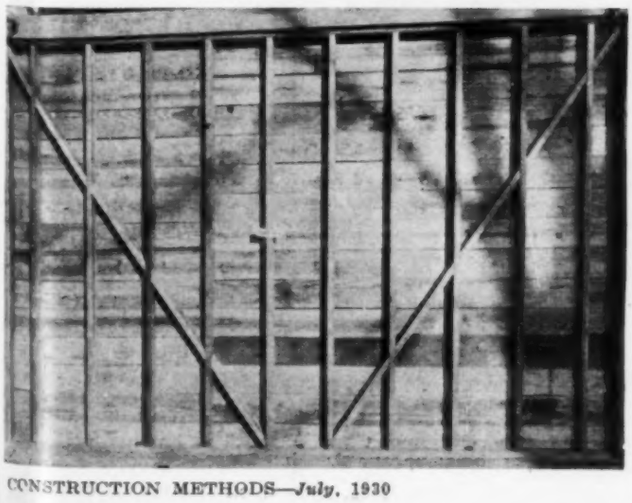
HERRINGBONE BRIDGING adds only 30 per cent to longitudinal stiffness of panel.

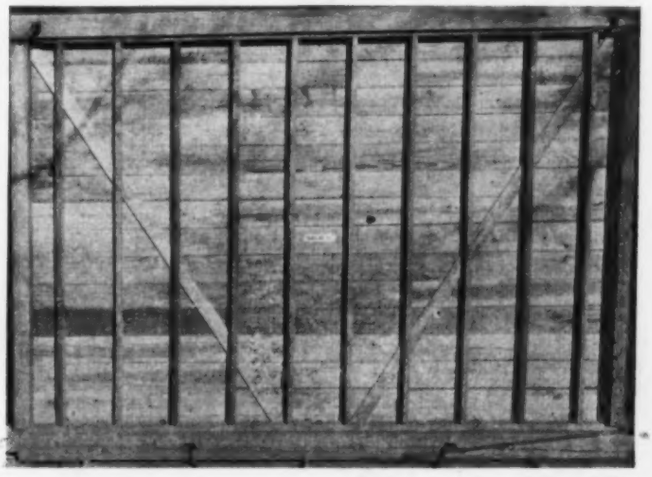


LET-IN DIAGONAL BRACING *(left)* is most effective stiffening system for walls with openings.

CUT-IN DIAGONAL BRACING between studs *(below)* adds only 50 per cent to rigidity of horizontally sheathed wall.

ANOTHER EXAMPLE *(below)* of diagonal bracing let into outside of studs.





Eighth of a series of articles on the $325,000,000 construction program for flood control in the Mississippi Valley

The Defense Against OLD MAN RIVER-VIII

By ROBERT K. TOMLIN
Editor of *Construction Methods*

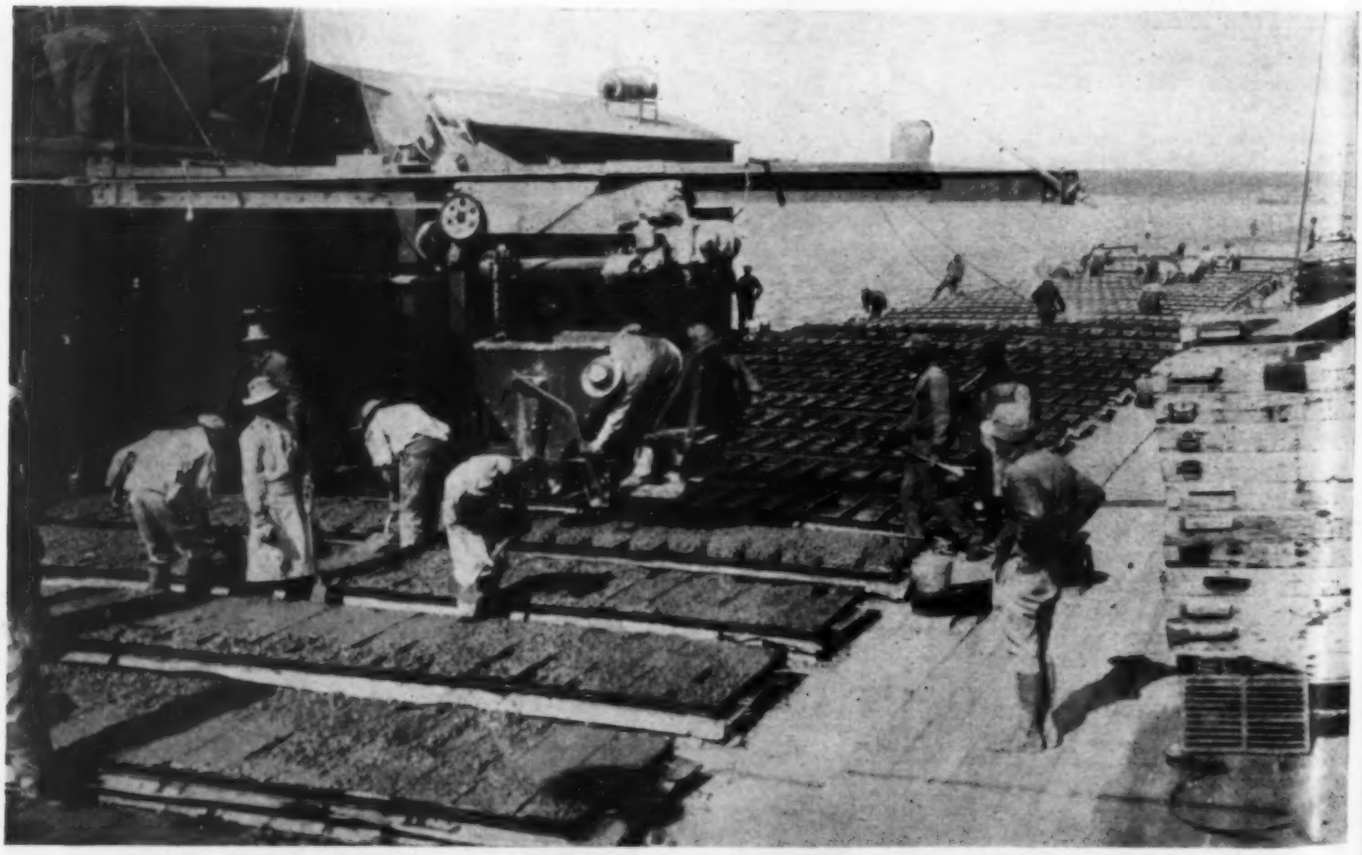
[Casting and Laying Articulated Mat Type of Concrete Revetment]

TO STABILIZE the meandering course of the Mississippi River and to protect its banks from caving in and washing away as the result of undercutting by the swift current, the Corps of Engineers, U. S. Army, is making and placing two radically different types of concrete revetment. One of these, the so-called lapped slab type, consisting of 6x11-ft. precast sheets of concrete 4 in. thick, sunk individually to form a "shingled roof" covering on the river bottom, was described in the March issue of *Construction Methods*, pp. 48-52. The other type—the articulated concrete mat—forms the subject of this month's article, the eighth in the present series on Mississippi flood control construction.

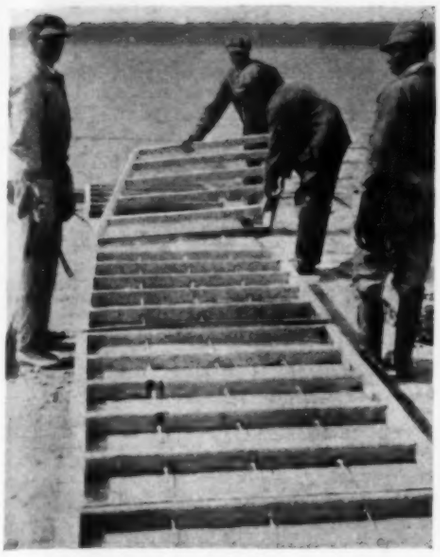
Precast Sections Flexible—The articulated type of revetment is essentially a huge concrete mattress of flexible units lowered to the river bottom from a barge equipped with rows of roller-bearing tracks on its sloping deck to facilitate the mat-launching operations. It consists of an assembly of precast mat sections, each 25x4 ft. in plan and 3 in. thick; each mat section, in turn, is made up of 25 individual concrete slabs (11x46x3 in.) cast simultaneously in a long form with separating strips between pairs of blocks and tied together with No. 12 gage wire mesh reinforcement. This type of construction, with the concrete slabs strung like large, flat beads on the reinforcing wire, produces a flexible mat that readily conforms to irregularities in the surface of the river bed or sloping bank.

Preliminary to the mat-sinking operations the river bank is graded to produce an underwater slope usually not steeper than 3 on 1.

Floating equipment is utilized both for casting and for laying this revetment in the Vicksburg District, under the direction of Lieut. Morris W. Gilland, area engineer at Greenville, Miss., reporting to Major John C. H. Lee, Vicksburg (Miss.) district engi-



CASTING articulated concrete mat sections in stacks at Greenville, Miss., floating plant. Steel forms on barges receive concrete from bottom-dump bucket traveling on long, horizontal boom from 1-yd. mixer. Bucket may be raised or lowered for proper clearance over slab forms as stacks increase in height. Paper sheets separate slabs in each stack.



TRANSVERSE STRIPS in steel forms divide mat section into 25 slabs and hold reinforcement which ties them together.

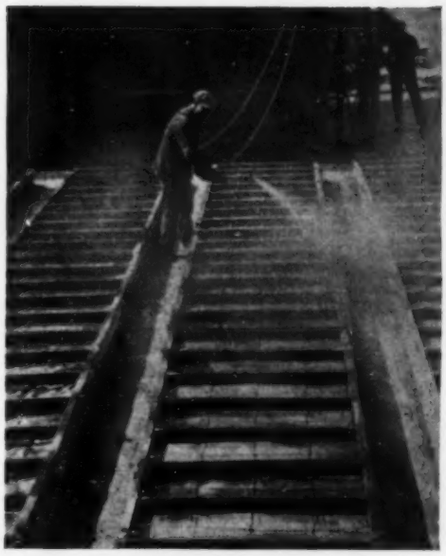
neer. Aggregates for the concrete are dredged from a bar in the river north of Greenville and delivered in barges to the floating mixing plant. Here two electrically operated Industrial-Brownhoist cranes, with 45-ft. booms and ¾-yd. clamshell buckets, transfer the sand and gravel to Butler bins on the

LIEUT. M. W. GILLAND, area engineer, Vicksburg District, in charge of concrete revetment.

mixer barge, a 36x120-ft. steel hull carrying two 1-yd. Lakewood paving mixers. Cement, received by rail at Greenville, is transferred to storage barges and rehandled by Barber-Greene belt conveyors to an 11-ton hopper on the mixer barge. Proportioning is done by weight with Johnson batchers.

Concreting Methods — The mixers discharge into individual reservoir hoppers feeding special bottom-dump buckets, which travel outward over forms on casting barges. The buckets, Industrial-Brownhoist units, operate on trolleys running in and out along the flanges of long, horizontal I-beam booms. In addition to their horizontal movement, the buckets may be raised or lowered to provide the desired clearance above the forms on the casting barge. All mixing and material-handling operations are controlled electrically, power being supplied by a 440-volt a.c. General Electric generator driven by a 225-hp. 6-cylinder Winton diessel engine.

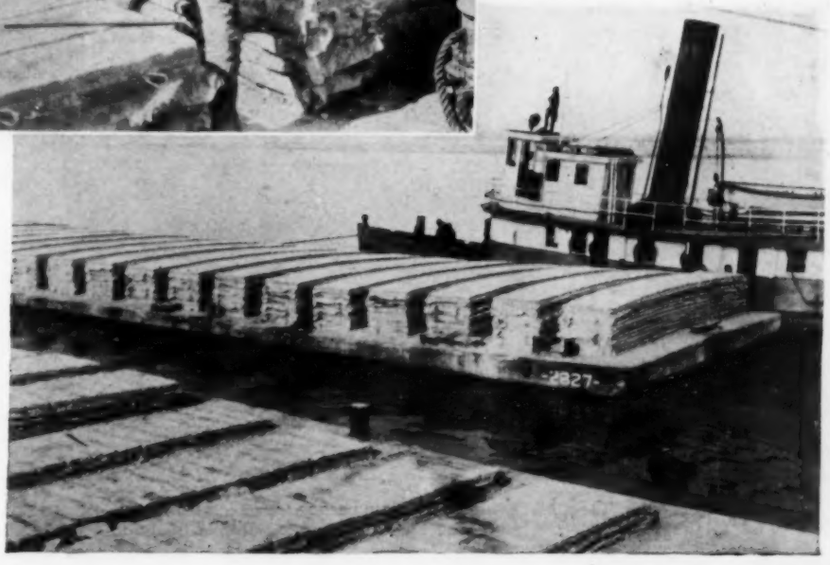
Mats Cast in Stacks—In pouring concrete for the mat sections the mixer barge moves along a line of casting barges carrying steel forms into which concrete is dropped by the traveling buckets from the mixers. The mats are cast successively in stacks of 15, one on top of the other, with craft paper separators between each pair. The mixer plant is designed for an average output of 800 mat sections or "squares" (each measuring 4x25 ft. or 100 sq.ft) per 10-hour day. Each casting barge has a deck surface of 30x120 ft., accommodating 20 stacks of 15 mat sections each, or a total of 300 articulated mat sections per barge. A 5-hour interval (for setting of concrete and preparation of forms) elapses between pourings of successive mats in the same stack, so that a string of 20 casting barges is required to maintain the mixer barge output of 80 mat sections per hour.



OIL IS SPRAYED by compressead air on the top forms of each stack just prior to the concrete casting operations.

GRAPPLE FRAME *(left)* on crane boom picks up articulated slabs from barge by means of a series of hooks which engage the protruding longitudinal reinforcement wires at each side.

SLABS *(below)* cast in stacks of fifteen, are towed to the laying barge for assembly into mats.



Floating Plant—For the mixing and casting operations the major items of floating plant required for a single 10-hour shift, with an average output of 800 "squares" of revetment per day, is as follows: 1 mixer barge; 2 cement barges; 16 to 24 casting barges (in line); 40 casting barges (in curing storage); 2 shop barges; 8 spar and header barges; 1 quarterboat (for housing construction personnel); 2 small towboats; 1 gravel digger; 6 to 8 sand and gravel barges; 2 gasboat tenders. In addition a total of 2,000 sections of mat forms is provided.

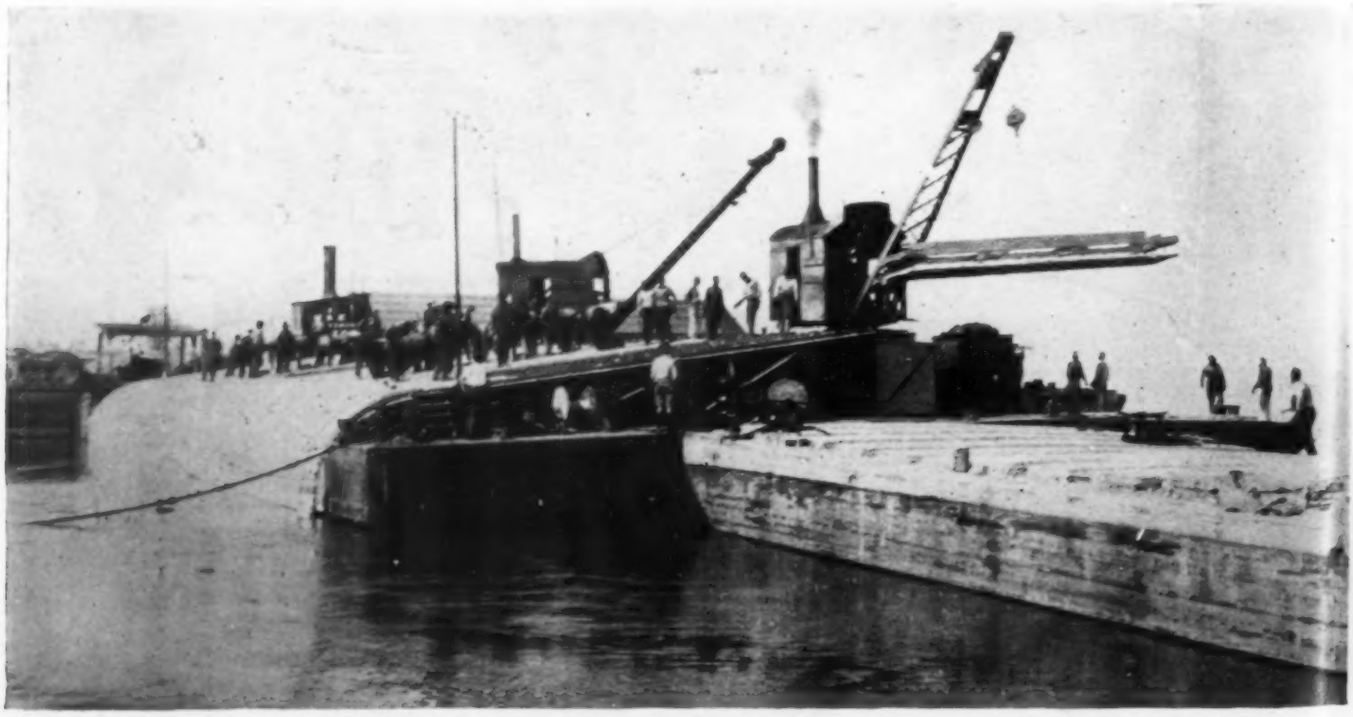
Forms—The forms for the mat sections, as illustrated, are of steel, with sliding clips to hold 12x12-in. galvanized wire mesh reinforcement in place. The side pieces are 3x2x$\frac{3}{16}$-in. angles and the cross members (forming the 25 individual slabs in each mat) are of sheet steel. As each form is filled from the bottom-dump traveling buckets laborers spread the concrete evenly with broad hoes and smooth it off with flat, square-pointed shovels. Thirty minutes after pouring each form is raised and allowed to settle back, thus breaking the bond between the concrete and the metallic form surfaces. Stripping of forms occurs 4 hours after pouring. After a piece of 50-lb. craft paper, acting as a separator, has been placed on a mat section already cast, a form, with its wire mesh reinforcement clipped in place, is superimposed to receive concrete for the next "lift" in the stack. Forms are sprayed with oil before each cast.

MIXER SKIP on barge receives its charge from V-body cars running on rails from aggregate bins.

Electric power, with its attendant advantages of remote control, has been utilized wherever possible. Every machine operator has been placed where he can best view his job. The operator who spots the mixer barge opposite forms on the casting barge is placed with his control boxes under the mixers and in line with the boom. The bucket operators ride on a seat on the end of the bucket; one operator regulates the rate of travel along the boom and the opening of the bucket dump, while the other controls the clearance of the bucket over the forms. The electric cranes move on a slightly elevated track so that the operator may command full view of the gravel barge.

Laying Revetment—When a full barge-load of 300 mat sections has been cast and allowed to cure for 14 days it is towed to the revetment-placing barge anchored along the river bank which has been graded to receive the subaqueous concrete mat. The larger of the two placing barges now in service provides space for the assembly of 35 mat section units or "squares" into a single large articulated sheet of concrete 140 ft. wide and covering an area of 3,500 sq.ft. The deck of the barge is on a slope and to facilitate the launching of the concrete mat is fitted with parallel rows of Northern Conveyor Co. rollers, as shown in one of the photographs.

With the aid of special grapple frames provided on each side with rows of hooks to engage the protruding wire-mesh reinforcement of the concrete slabs, two Osgood locomotive cranes pick up the mat sections from a barge alongside the laying barge and swing them on to the roller ways where they are assembled into a huge flexible blanket by anchoring cables, U-bolt clips and wire ties engaging the protruding wires of the slab reinforcing mesh. The U-bolt clips are set at 5-ft. intervals to grip the outside longitudi-



ASSEMBLING THE MAT on the laying barge. Crane with grapple frame has just picked up slab and is swinging it over on to the roller ways. Note that mat is made continuous by joining new sections to those partially submerged and extending over curved edge of laying barge.

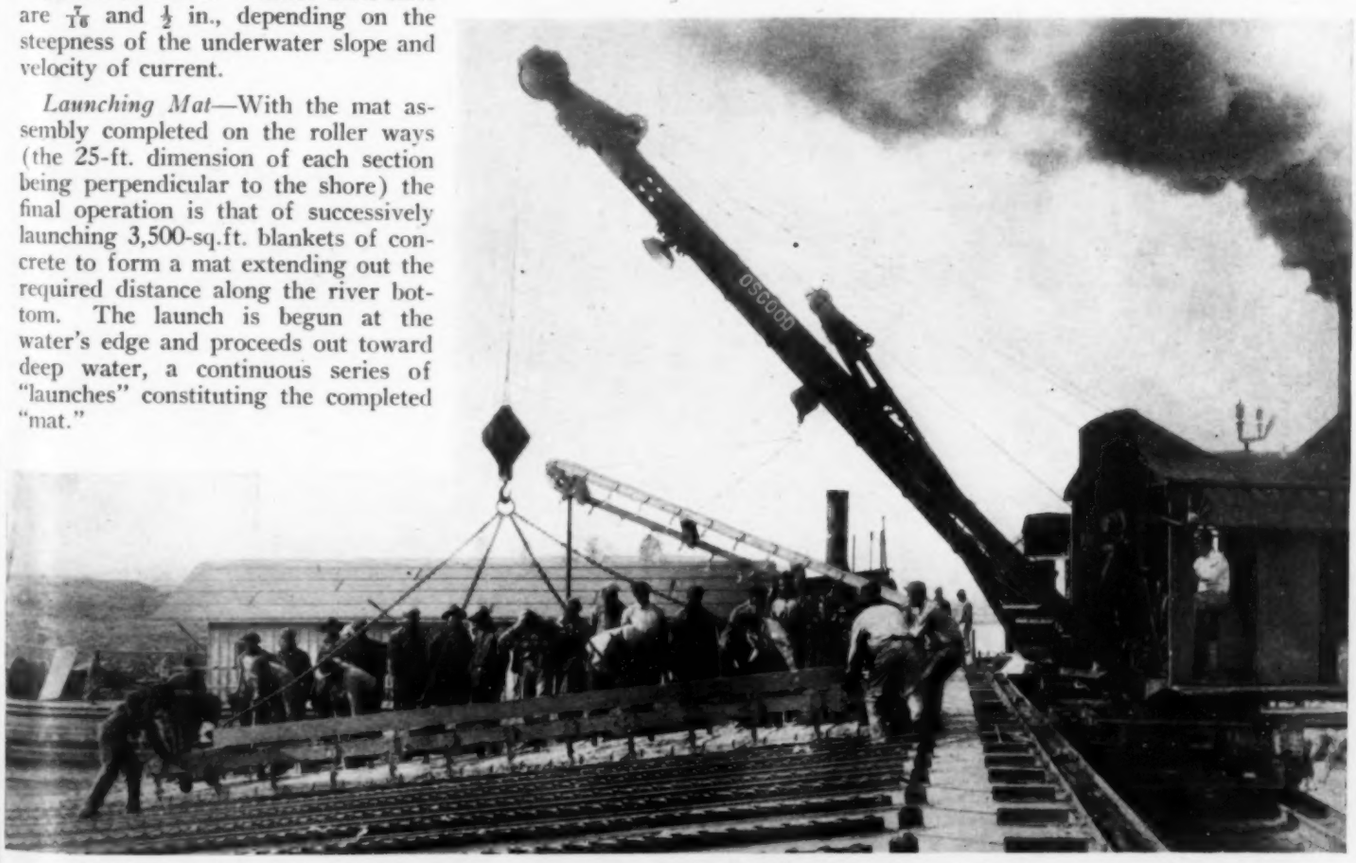
JOINING MAT SECTIONS on the laying barge. Twisted wire ties *(above)* engage reinforcement of adjacent slabs and anchoring cable at 1-ft. intervals and U-bolt clips *(right)* are inserted and screwed up tightly *(left)* every 5 ft. with special hand tools. All U-bolt parts are Jappaned to prevent rusting.

nal reinforcing wires of adjacent slabs and also the anchoring cable between them. Additional security is furnished at 1-ft. intervals by galvanized wire ties doubled and tightly twisted to link the slab reinforcement and the anchor cables. Each anchoring cable between pairs of mat sections on the laying barge is carried to a sound stump or deadman on shore. Anchor cable sizes are $\frac{7}{16}$ and $\frac{1}{2}$ in., depending on the steepness of the underwater slope and velocity of current.

Launching Mat—With the mat assembly completed on the roller ways (the 25-ft. dimension of each section being perpendicular to the shore) the final operation is that of successively launching 3,500-sq.ft. blankets of concrete to form a mat extending out the required distance along the river bottom. The launch is begun at the water's edge and proceeds out toward deep water, a continuous series of "launches" constituting the completed "mat."

With all anchoring cables secured to their deadmen on shore the laying barge is slowly pulled away from the river bank by cables from a Clyde hoisting engine, allowing the articulated concrete mat to slide down along its roller tracks into the water. The operation suggests the closing of a roller-top desk. Each "launch" is halted before the off-shore ends of the mat sections have entered the water, so that the succeeding "launch" can be hooked up to the end blocks of the one partially submerged and the mat made continuous.

Where a length of river bank is to be revetted, work is begun by laying the first mat at the downstream end,



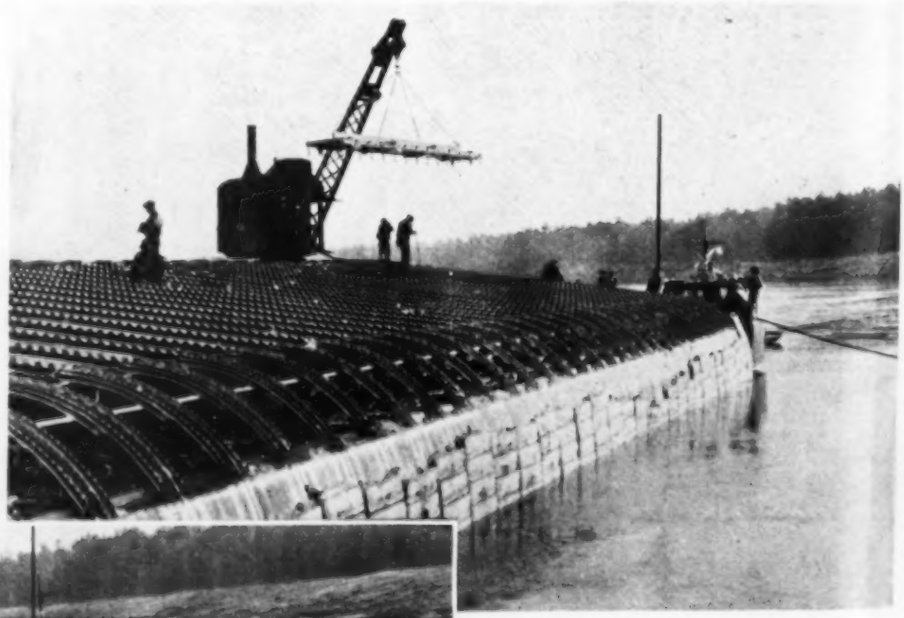
LANDING A MAT SECTION for assembly on the roller ways of the inclined deck of the laying barge. Crew is releasing grapple frame hooks which engage the wire reinforcement extending out from each side of the slab. Locomotive cranes, in duplicate, operate on tracks on barge deck.

READY FOR LAUNCHING. Articulated sections of concrete mattress have been tied together on laying barge and joined to the upper edge of the portion of mat already partially submerged, forming a continuous flexible blanket 140 ft. wide.

with successive mats overlapping at least 10 ft. to prevent the river current from overturning the upper edges of the mat.

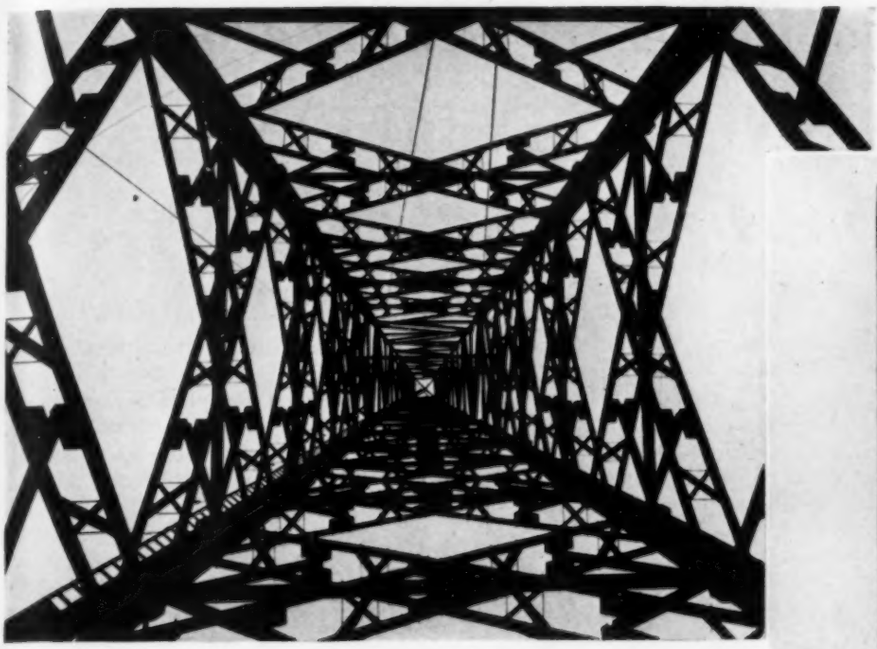
After the subaqueous concrete mats are in place the revetment work is completed by protecting the upper bank above the water line either by monolithic reinforced concrete paving 4 in. thick or by a series of the 4x25-ft. articulated mat sections placed individually side by side, by a crane or a stiff-leg derrick mounted on a barge. In the latter case the ends of the mats are overlapped two blocks, giving a stronger job and eliminating construction difficulties in securing a close fit between the end sections.

For revetment construction of the type described ideal conditions are those that permit grading at a low river stage, placing subaqueous mat at nearly bankfull stage, and upper bank paving at medium river stage. Such ideal conditions, however, rarely occur in sequence and it is often necessary to place subaqueous mat at a low river stage.



LIKE A ROLLER-TOP DESK, the mat slides to place on the river bottom as the laying barge is slowly pulled out from shore by cables from hoist engine. ROLLERWAY TRACKS *(below)* are spaced so that every slab is supported by a pair of tracks, one at each side.

[NEXT MONTH: Another article on construction for Mississippi River flood control.]

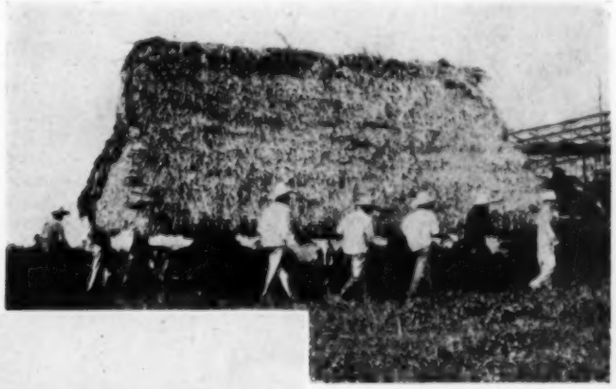


SPIDER WEB EFFECT is produced by looking up through one of the huge steel towers recently completed for a new radio broadcasting station at Cologne, Germany.

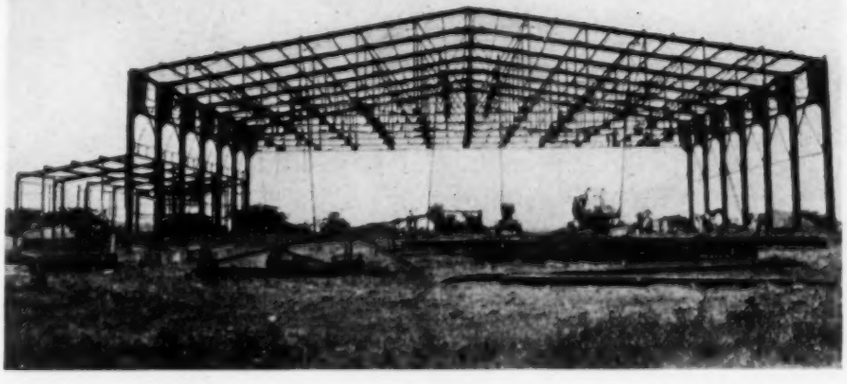
JOB ODDITIES

A Monthly Page of Unusual Features of Construction

MAMMOTH CORE, 8 ft. long and 17 in. in diameter, is removed by Acker Drill Co., Scranton, Pa., from trap-rock concrete between floor and water tunnel of power house at Holland, N. J., to accommodate condenser pump suction lines. Drill was portable, belt-driven rig, using chilled steel shot as cutting medium.



Photos from
R. M. FERNANDEZ
Chief Engineer,
Ingenieros y
Contratistas
"Martin," S. A.,
Mexico City, D. F.



HANGAR CONSTRUCTION at Vera Cruz, Mexico. Yoked oxen deliver sand, stone and other materials. Grass shacks in path of airport runways are picked up by hand and carried to new sites.

Michigan Stabilizes Deep Peat Marshes BY BLASTING AND FILLING *to Prevent Highway Settlement*

By C. F. BOEHLER
Engineer of Design & Plans, Michigan State Highway Dept.

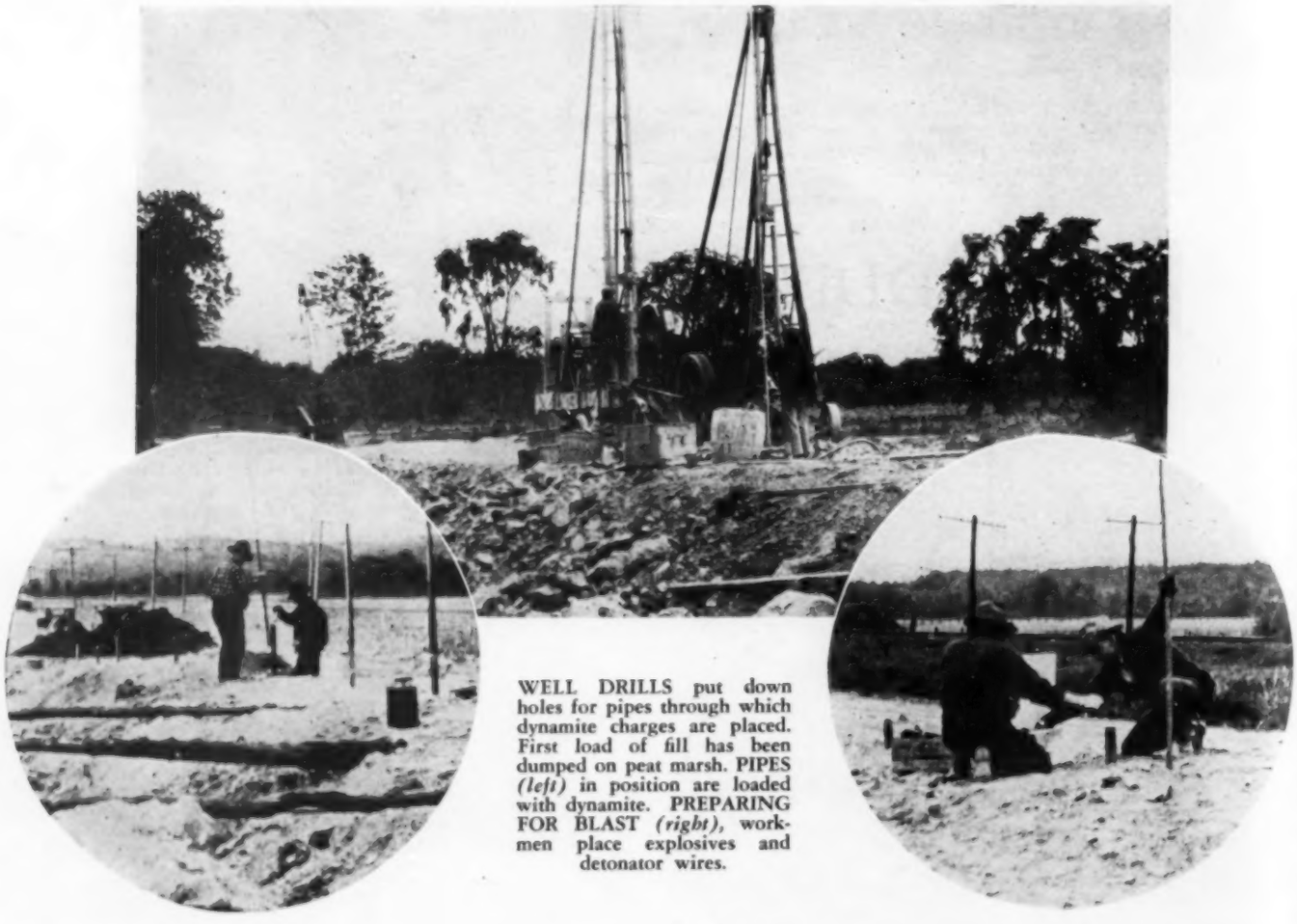
MICHIGAN is in the heart of a glacial region containing a vast number of lakes and ponds. Many former lakes, ponds and swamps have been entirely filled up with vegetable matter, and, in place of open water, they now consist of peat deposits varying in depth from a few feet to as much as 60 ft.

Although on the surface these lands appear satisfactory for road locations, the foundation is unstable and offers a serious problem for the road engineer and road builder. Such peat deposits are so numerous and widely scattered that many road projects encounter one or more marshes varying from less than 100 ft. to more than a mile in length and from a few feet to more than 40 ft. in depth.

Old Method of Building Across Marshes—Prior to the period of modern highway improvement, roads through swamps were generally built of corduroy, the corduroy later being covered with a layer of earth varying from 1 ft. to several feet in depth, with a surfacing of gravel or macadam added in many cases. Such methods of construction served their purpose but were never entirely satisfactory and are not adequate for modern requirements. In the case of deep peat deposits, there has been a settlement of the surface and the development of so-called sink holes, where year after year fill material has to be added to compensate for repeated settlement of the surface.

For about 5 years a serious attempt has been made to control settlement on road projects, and a technique has been developed to eliminate all potential sink holes by getting full settlement at the time of grading the road. The first step is to get accurate information as to the location and depth of peat deposits. This information is obtained on road surveys by taking rod soundings and making borings. The next step is to apply the proper corrective measures.

The old practice of attempting to "float" fills on top of peat marshes by disturbing the surface mat as little as possible has been unsuccessful for modern traffic conditions, and the present theory, substantiated by facts, is



WELL DRILLS put down holes for pipes through which dynamite charges are placed. First load of fill has been dumped on peat marsh. PIPES *(left)* in position are loaded with dynamite. PREPARING FOR BLAST *(right)*, workmen place explosives and detonator wires.

that settlement will occur anyway and, therefore, the sooner it is accomplished the better. Methods, accordingly, are designed to accelerate settlement to the maximum.

Treatment of Shallow Deposits—On new locations where the peat is 8 ft. or less in depth, it is excavated to firm bottom 2 ft. wider on each side than the proposed pavement, and the trench is filled to grade with firm material. On old road locations where the depth of old road fill above the natural ground is less than the depth of peat or where corduroy is present, the underlying peat is excavated the same as on new locations. However, if the depth of old road fill above the natural ground is greater than the depth of peat and if corduroy is not present, trenches 8 ft. wide are excavated along each side of the old road grade to firm bottom and these trenches are backfilled with firm material before the road is filled to plan grade.

EARTH LOAD HEAVES before settling back into place. Blast disrupts peat beneath fill, permitting settlement and consolidation

Where the peat varies from 8 ft. to 20 ft. in depth, the surface mat is broken up by blasting a trench along each side of the road from 10 ft. to 15 ft. from the center line. The propagation method of blasting is followed, using one stick of 50 per cent straight nitro-glycerin dynamite in each hole. The holes are spaced 18 in. apart in the rows. After the preliminary blasting is done, earth fill is made in two runways centered 15 ft. from the road center line on either side, to a top width of 10 ft. and to an eleva-

BLAST *(left)* in peat marsh breaks surface mat and prepares for compaction under fill when placed. FILL *(below)* is placed in sink hole after blasting. Note upheaval of peat in right foreground

tion 5 ft. or more above plan grade. This extra weight of material is designed to compress the underlying peat and to entrap and compress the peat lying between the two runways.

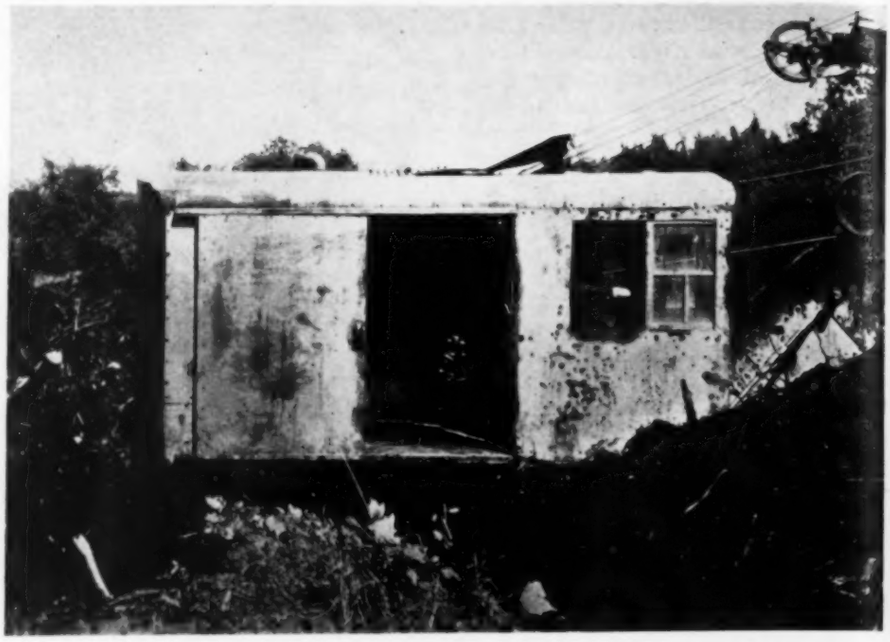
Procedure in Deep Marshes—Where the depth of peat is more than 20 ft., the preliminary blasting is conducted the same as in the case of peat from 8 to 20 ft. deep, except that the blasting is omitted where the peat is soft and there is no dense surface mat. The first loading is made in a single runway along the road center line to a top width equal to the proposed future pavement width and to a height of 5 ft. or more above plan grade. The purpose of this loading is to displace the peat by forcing firm material as far down into the peat as possible.

After the first loading is complete, 2-in. pipes, plugged on the bottom end, are driven 10 ft. apart in rows at a distance from the road center line of 10 ft. in the case of future 20-ft. pavement, or 20 ft. in the case of future 40-ft. pavement, and to a depth half way between the bottom of the first loading and the bottom of the peat. After the pipes are placed, the plugs are removed and one stick of dynamite shot in each hole to form a chamber. Then, from twenty to 30 sticks of 50 per cent straight nitro-glycerin or gelatin dynamite are placed in each hole and shot. A minimum of twenty charges are shot at one time, and both rows are shot together. This blasting so disrupts the underlying peat that the weight of the fill causes immediate settlement.

After the second blasting, in all cases of peat marshes more than 8 ft. in depth, the grade is filled along the road center line to a top width equal to the proposed pavement width and to an elevation 5 ft. above plan grade. This loading is left in place until settlement has ceased, when the excess load is cut down to plan grade and the surplus material used to widen the fill. The excess load is designed to displace as much peat as possible and, where some peat remains under the fill, to compress it so that further settlement will not take place after the excess load is removed and the pavement placed and subjected to traffic.

It has been found that large charges of dynamite concentrated at 10-ft. intervals are much more effective in disrupting the peat than smaller charges at closer intervals. There appears to be considerable variation in the action of different sink holes; but, if full settlement has not already been obtained by the first loading, the second blasting and second loading generally are effective in getting the new fill down to satisfactory foundation.

By following these methods in the grading of the road, settlement of pavements has been eliminated over a large proportion of peat marshes. In the exceptional cases where full compaction has not been obtained in the grading, pavement settlement has been greatly reduced.



EXCAVATION of peat to firm foundation is sure method followed where deposit is less than 8 ft. deep

READY FOR FILL of sound earth. Peat layer has been stripped by shovel to solid bottom

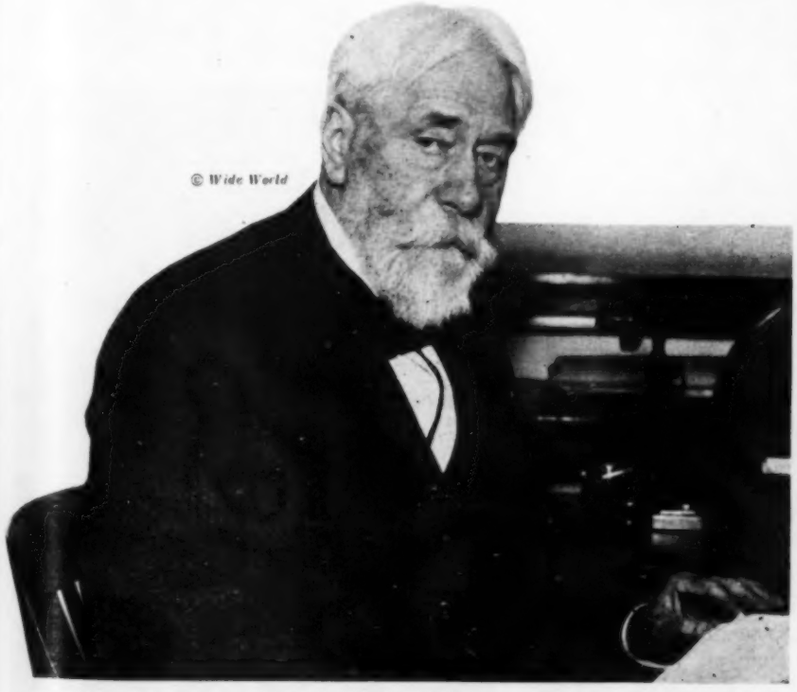
Present and Accounted For —

A Page of Personalities

DAVID A. CHALLIS, of Sewickley, Pa., head of the contracting firm that bears his name, is the new president of the Associated Pennsylvania Constructors, local branch of the A.G.C.

GEORGE D. BROOKE, general manager of the Chesapeake & Ohio Railway, was elected president of the American Railway Engineering Association at this year's annual convention in Chicago. He began railroad work in 1902 as rodman on the B. & O.

HARRY J. KIRK *(left)*, formerly director of the Ohio Highway Department, has joined the staff of the Associated General Contractors, with headquarters at Washington, D. C.



GUSTAV LINDENTHAL, internationally famous bridge engineer and honorary member of the American Society of Civil Engineers, was guest of honor at a luncheon held at the Engineers' Club, New York, May 21, to celebrate his 80th birthday.

H. J. HARDER has just completed 30 years of continuous service as city engineer of Paterson, N. J. Appointed May 10, 1900, he has directed an extensive program of grade crossing elimination in addition to other duties connected with waterworks, sewerage and paving improvements.

NEW EQUIPMENT ON THE JOB

Large, Mobile Dragline

A 2-yd. dragline for use on drainage and general construction work has been announced by the Northwest Engineering Co. of Chicago.

This unit's 2-yd. bucket is handled by a 50-ft. boom at a 40-ft. radius.

The machine is equipped with crawlers 17 ft. 5 in. long and treads 33 in. wide, providing a bearing area capable of carrying the machine over extremely soft ground. It is powered by a Northwest variable-speed motor.

The dragline can be loaded on one flat car with no major dismantling.

All-Steel Highway Crossing

Built to withstand the heaviest traffic loads, the new all-steel highway crossing now being marketed by Joseph T. Ryerson & Son, Inc., has

great sturdiness and simplicity of construction.

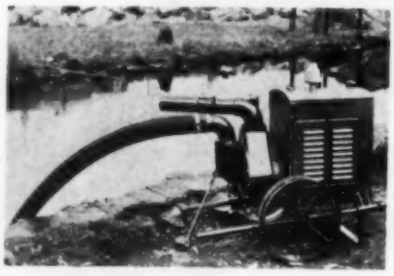
The crossing is made of ¼-in. steel plates riveted to steel channels and zees. In installing the highway crossing, the outer plates are secured by placing the ends under the ball of the rail and locking them with rail clips and anchor rods. After the center beam has been spiked firmly to the ties, the flangeways of the two center plates are slipped under the ball of the rail and the plates are locked with a patented device. Four men can place an 8-ft. section of crossing in ½ hour.

Safety features include: Plates with a tread to prevent skidding; a smooth riding surface, and, in general, freedom from snow during winter storms.

Where electric insulation of the rails is required, two rolled steel channels with a 1-in. strip of creosoted wood between are bolted together and then spiked midway between the rails in place of the center I-bean. The ends of the crossing are bent downward to prevent catching of chains or air hose dangling from vehicles.

Self-Priming, Portable Pump

A new, self-priming, portable 4-in. centrifugal pump with built-in gasoline engine has been added to the line of



the Homelite Corporation, Port Chester, N. Y.

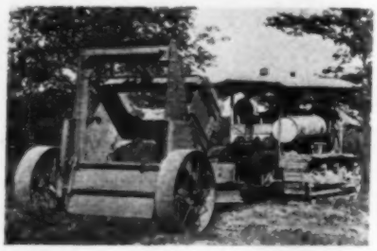
As in other Homelite units, the pump is self-priming without the use of auxiliary pumps or vacuum apparatus. Pump capacity is 25,000 gal. per hour, suction lift, 20 ft. It is powered by a Le Roi gasoline engine and weighs 730 lb.

Road Stone Oiled to Increase Asphaltic Coverage

Penolithic is the name applied to a type of asphaltic macadam pavement announced by Warren Bros. Co., of Boston. The pavement is constructed in place by the penetration method. The innovation in method consists in coating the stone with a mobile, nonvolatile oil prior to the application of the hot asphaltic cement. This oil coating, it is claimed, increases the covering power of the asphalt, allowing it to flow around and adhere to the sides as well as to the tops of the stone particles, increasing the strength and stability of the pavement structure. This method, it is said, also permits the use of a harder asphalt than is ordinarily employed on penetration work.

Low Cost Earth Mover

Moving large yardages at low cost is a feature of the "True Cut" scraper built by the Shaw Excavator and Tools Co., Worthington, Ohio. Constructed for use with Caterpillar tractors, it may be used for digging or spreading, these



operations being controlled by a cable winding winch on the rear of the tractor. The 4-yd. bucket will make a cut 8 in. deep and 5½ ft. wide.

Based on operation and maintenance cost, including the tractor driver, of $25 per 10-hour day, the scraper and tractor will move 600 yd. at a cost of 4 1/5c. a yard on hauls of 400 ft. or less.

Wheelbarrow Batcher

For building, culvert, small bridge and curb and gutter work where the size of the job does not justify the setting up of a complete bin and batching unit, the C. S. Johnson Co. of

Champaign, Ill., has brought out a Bantam Weigh Batcher for wheelbarrow batching of aggregates. As it weighs but 280 lb., it can be transported on a truck or moved around on two large-diameter wheels by one man. The shoveling height of 42 in. prevents undue tiring. The capacity is 4 cu.ft. or 400 lb., a full wheelbarrow load. A sliding gate provides an exit for the batches.

The UNIVERSAL *Truck Crane Says it in Dollars and Cents!*

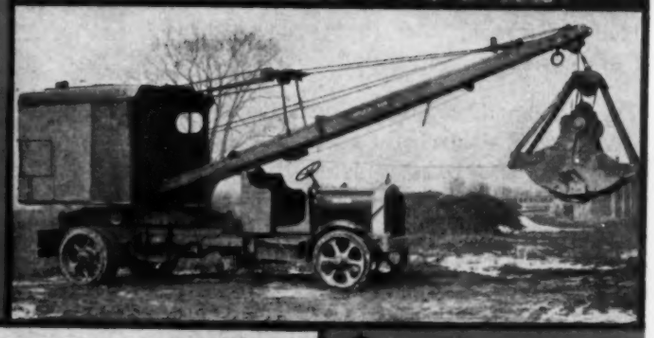
TRAVELING from job to job at motor truck speed the Universal Truck Crane can easily serve a territory of 50 to 125 mile radius, a territory which in the average community is full of profitable crane jobs. The illustrations and figures here tell the story. More facts will be sent you on request.

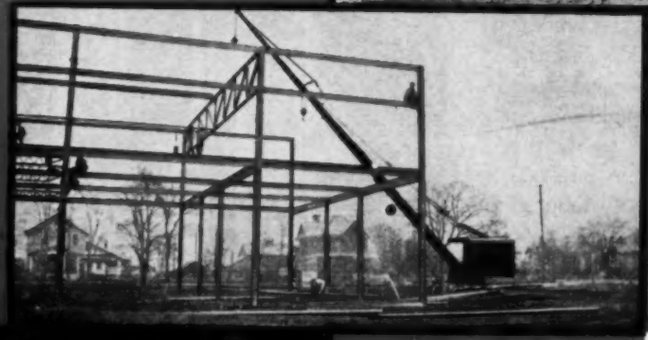
THE UNIVERSAL CRANE COMPANY
LORAIN, OHIO

$450.00 earned in 5 days. The job was a garage basement excavation where both trucks and cranes worked from the top.

$

A 7½ ton capacity crane with 24 ft. boom and ½ yard clamshell that earned $1379.54 in 25 days on 20 different jobs.





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This one Universal Truck Crane earned $3311 in three months, working on jobs that required anywhere from 2 hours to 3 days. The owner has a fleet of six Universal Truck Cranes — all making money.

For big jobs or little, sooner or later you will need a machine that combines the mobility of a motor truck and the versatility of a 5 to 7½ ton crane.

UNIVERSAL

Roebling

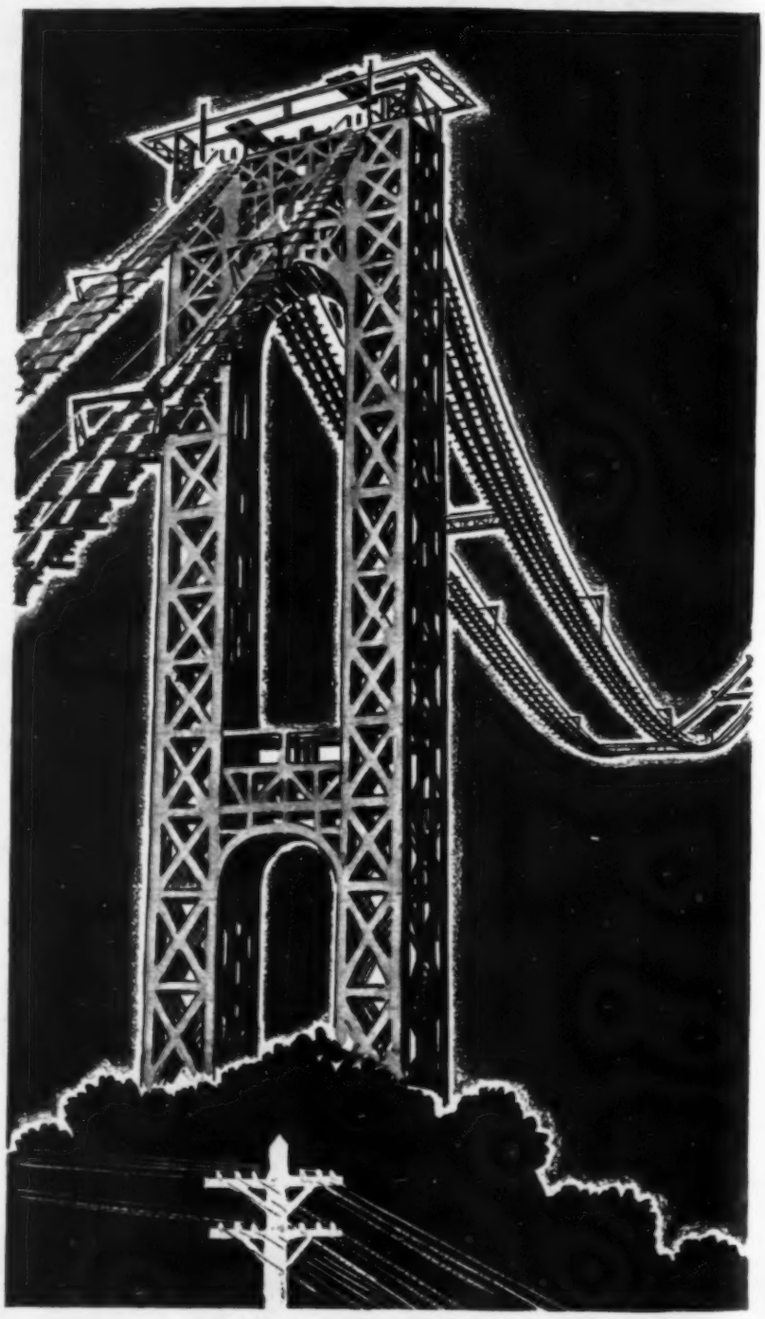
NEARING COMPLETION!

One year ago, the first foot bridge cables were lifted into position on the towers of the world's greatest suspension bridge, connecting New York and New Jersey across the Hudson River and *today*, the spinning of the four mammoth cables is almost completed.

The Roebling Company has been identified with most of the famous suspension bridges erected in this country during the past century. From the building of the first parallel wire suspension bridge over the Niagara River, to the mighty span now in construction across the Hudson, is a far cry.

Essentially, the same aerial spinning process invented by John A. Roebling in 1854, for the construction of the *10-inch diameter* cables on the Niagara suspension bridge, is employed on the monster *36-inch diameter* cables for the new Hudson River Bridge. Improved methods of spinning, however, have greatly reduced the time required for this task, and the work which occupied thirteen years for completion on the Brooklyn Bridge, will be accomplished on the mighty Hudson River Bridge in five years or less.

In the erection of this span, Roebling Products other than the wire for the cables will play a prominent part. Over 500,000 feet of Wire Rope in sizes from ½" to 2⅞" diameter; 60,000 feet of Steel Wire Strand; 485,000 feet of Electrical Wires & Cables; 92,000 square feet of Wire Netting; hundreds of "Blue Center" Steel Wire Rope Slings; thousands of Wire Rope Fittings and many other products in lesser quantities have been used.



John A. Roebling's Sons Company

Trenton, New Jersey

Watertown Builders Supply Company, 418 Arsenal Street, Watertown, Mass.—another company which uses Goodyear Tires exclusively.

It stands to reason you can haul more

BUILDING MATERIALS

on Goodyears

Everybody wants long service from tires. Everyone wants freedom from trouble. Everyone wants safety—and a low cost per mile.

It stands to reason that the tire which meets these requirements best is the tire that will be most widely used. And *more tons are hauled on Goodyear Tires than on any other kind*—which is another way of saying that more truck owners find Goodyear Tires best suited to their requirements.

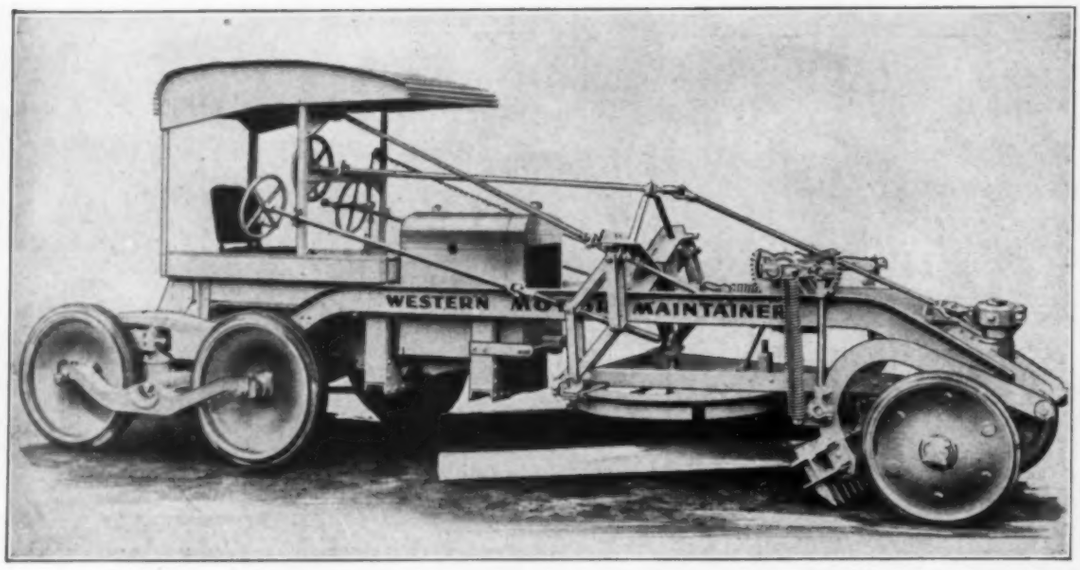
Goodyear builds a special tire for dump truck service. Extra broad of tread—reinforced on sidewalls—it's a mighty tire for hauling around excavations. It has traction that pulls through where other tires mire down. It stands the scuff and jab of rolling over curbs and beams. On slower trucks, many use the Goodyear Super Heavy Duty Cushion—and trucks that want to make extra speed on the open road and still have powerful traction are adopting the new Goodyear Truck Balloons.

• • •

Goodyear Truck Tire Service Station Dealers can give you accurate recommendations for the right type and size of tires for your kind of hauling. It will pay you to know what they have to offer.

GOODYEAR

ON YOUR NEW TRUCKS SPECIFY GOODYEARS



The new *Tandem drive* Western Motor Maintainer—

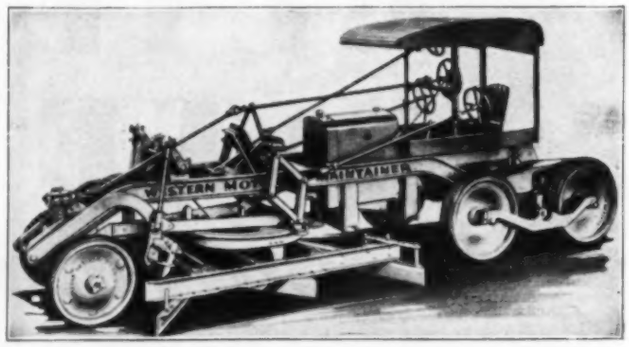
Medium size . . . greater handling ease . . . more power . . . 4-point driving contact over wide area provides more effective traction

The Western Motor Maintainer is easily one of the outstanding values in the Austin-Western line because of its many uses and its powerful Tandem Drive. It stands alone in the medium weight field—working under conditions that would prohibit the use of a two-wheel drive machine.

The unique Tandem Drive—without a differential gear—provides a 4-point, wide spread ground contact. *All four wheels are drive wheels*—one cannot revolve without the others. Think of what this means when the going is soft or wet! One or two wheels can fail to grip—no matter—the others will continue to drive the machine forward.

The Tandem Drive also has a remarkable ability to hold a straight course without skidding. The 4-point driving contact offsets any tendency of the front end to slide sideways even under the heaviest blade loads. Instead of one rear wheel providing a pivotal point, a base line several feet long offers stubborn resistance.

Contractors and public officials find the Western Motor Maintainer a very profitable investment.



Western Motor Maintainer equipped with drag and scarifier attachments.

Small, yet exceedingly powerful, it levels fills—works between forms and levels shoulders of improved roads of every type. It is a completely factory-built unit—economical to operate and sturdy enough to give years of hard service. A special transmission with forward speeds of 1, 2 and 4 miles per hour, is available at no increase in price. The regular blade is 8 feet. Multiple blade drag and scarifier attachments may also be supplied. When desired for any reason, the Western Motor Maintainer may be equipped with a crawler tread. Write for special bulletin. The Austin-Western Road Machinery Co., 400 North Michigan Avenue, Chicago, Illinois. Branches in principal cities.

Austin-Western
ROAD MACHINERY

Compressed Air Helps Control Destructive Flood Waters

On one contract alone, near Artesia, California, compressed air coated a dirt levee with half a million feet of concrete.

Without this protection, the dirt would be swept swiftly away by the churning waters of the San Gabriel.

The levee is 12,000 feet long, 13 feet high, and 8 feet wide at the top with an easy slope to the bottom.

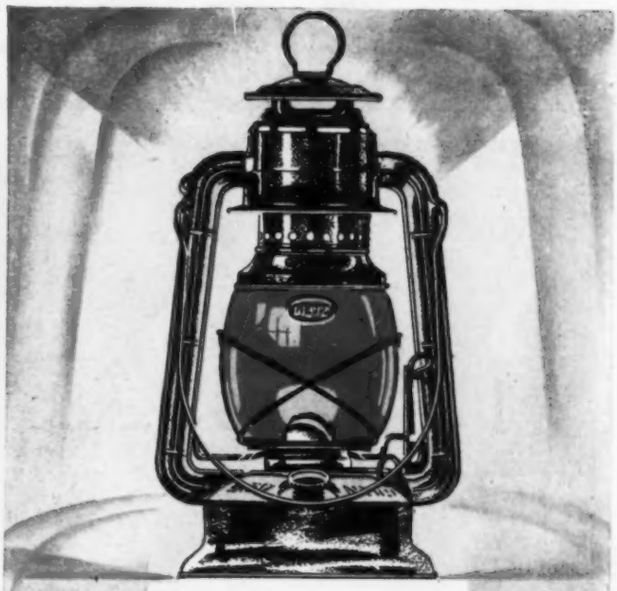
Over the silt is laid a layer of reinforcing steel. Around this, the mix is shot with Pneucrete guns, operated by Sullivan Vibrationless air compressors. The concrete coat is 1½ inches thick at the crest of the levee, increasing to 3½ inches in the toe mat.

Compressors run constantly at top speed. "And on this work, where pressure is so important"—says Manager Cassiere of the Pneucrete Company—"the superior delivery of the Vibrationless Compressor is outstanding." Smooth running, trouble-saving, fuel-saving air compressors are only one of several Sullivan contributions to more profitable contracting.

Send for the picture book "Speed Up with Air."

Sullivan Air Equipment

Sullivan Machinery Company
816 Wrigley Bldg., Chicago
30 Church Street, New York



IN THE PUBLIC EYE

Dietz Red Lanterns strung along roadside ditches are "Silent Cops" that speak a universal language louder than words—understood instantly, obeyed instinctively.

Dietz Red Lanterns combine all essentials of sure warning, thorough dependability and low cost.

In Dietz "Little Wizard"—illustrated—ordinary Red Lantern protection is enhanced by higher lighting power. Small size is another feature that makes "Little Wizard" a favorite with numerous Contractors.

USE RED
No other color means DANGER

R. E. DIETZ COMPANY
NEW YORK
Largest Makers of Lanterns in the World
FOUNDED 1840

A FORERUNNER

THIS beautiful 13-story office building under construction in Los Angeles for the Southern California Edison Company, Ltd. is prophetic of the all-arc-welded skyscraper of tomorrow.

For, although riveted connections will carry the vertical loads, arc-welded connections will carry the seismic loads and windbracing throughout. The total amount of welding required to make the connections will approximate 50,000 feet of fillet welds, varying in size from ⅜ inch to 1½ inches. In addition, a number of butt welds will be made.

Arc-welded shop fabrication, begun on Jan. 18, was completed March 10. Field welding began almost immediately with a crew of twenty-three operators and was completed by June fourteen. In fact, the satisfactory manner in which the arc welding has progressed has been a revelation to even the most ardent proponents of arc-welded buildings.

In this pioneer undertaking, it has been General Electric's privilege to supply twenty of the arc-welding sets used in shop and field—and the vital task of supervising the welding operations has been intrusted to a General Electric engineer.

Architects: Allison & Allison, Los Angeles
Steel, fabrication, erection and welding: Consolidated Steel Corporation, Ltd., Los Angeles
Engineering: Southern California Edison Company, Ltd.

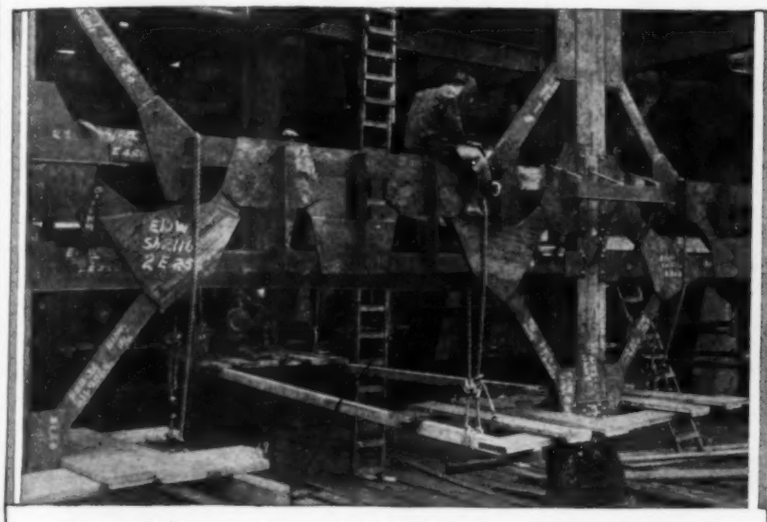
* * *

When preparing specifications for arc-welded buildings, remember that General Electric builds: single-operator sets for shop and field welding; multiple-operator and automatic sets for shop fabrication; automatic equipment for the new "battledeck"-type steel flooring; also welding electrodes, and complete welding accessories. You will find your nearest G-E office a dependable headquarters for advice, engineering assistance, and equipment.

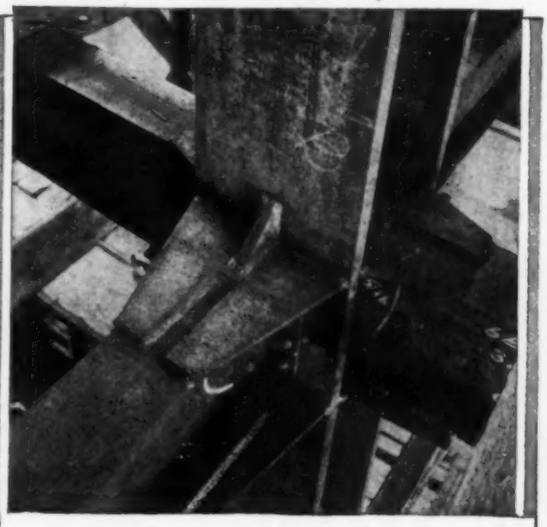
GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

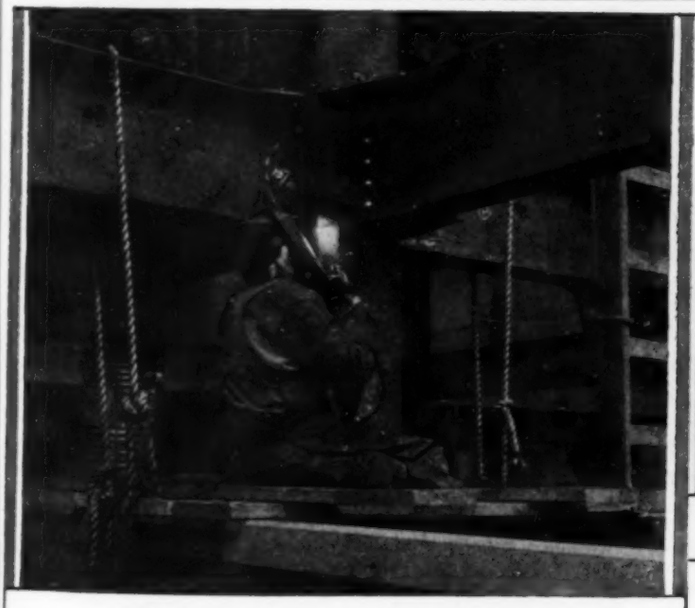
of the ARC-WELDED SKYSCRAPER



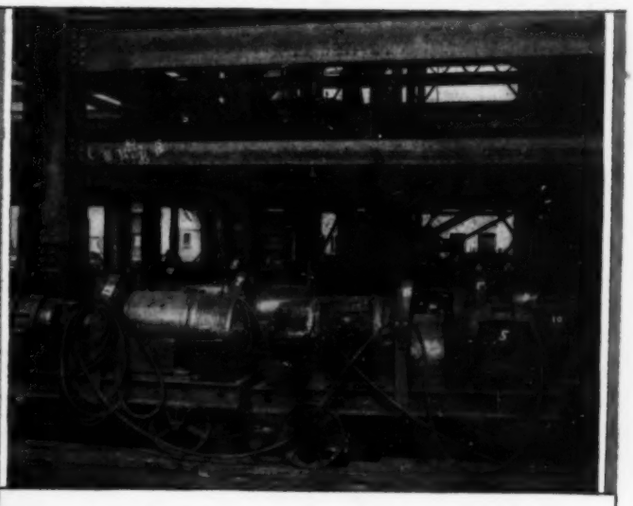
Welded spandrel trusses with vertical welded plates to carry masonry shelf angles



Beam-to-column connections, showing continuity plates



Making an overhead weld on a typical continuity plate



Some of the G-E welding sets on the mezzanine floor

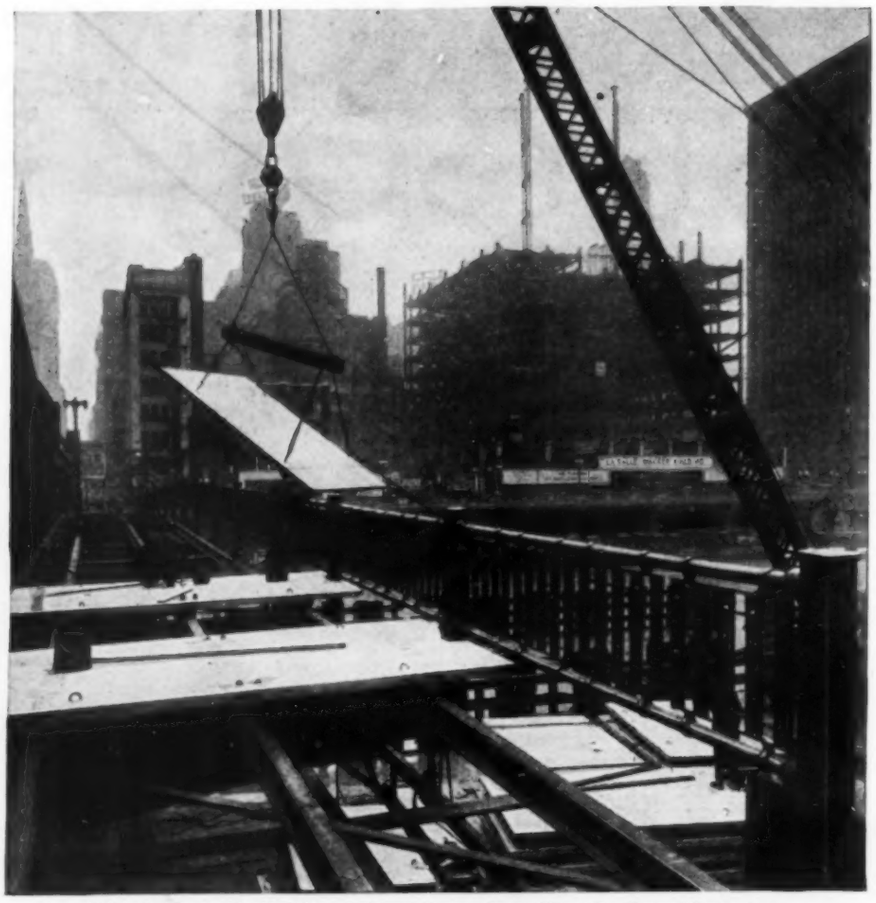
JOIN US IN THE GENERAL ELECTRIC PROGRAM, BROADCAST EVERY SATURDAY EVENING ON A NATION-WIDE N.B.C. NETWORK

530-89

ELECTRIC

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

5000 lbs. COMPRESSIVE STRENGTH IN 72 HOURS



Sidewalk slabs for the Clark Street Bridge, Chicago. Kettler Elliott Co., General Contractors
Benedict Stone, Inc., Manufacturers of Slabs.

THE use of sidewalk structural units on the Clark Street Bridge is an interesting development in bascule bridge construction. The slabs were designed and built under the supervision of Loren D. Gayton, City Engineer; and Major Paul Schioler, Bridge Engineer. • Produced by Benedict Stone, Inc., with "INCOR" Cement and light aggregate, the slabs tested 5,000 pounds compressive strength in 72 hours and produced an absorption of less than 2% by weight. Slabs 7' wide, 15' long and 2½" thick were cast in the afternoon . . . forms were stripped the same day and slabs removed to the curing room the next morning. • "INCOR" Cement rendered a two-fold service . . . saving valuable time in manufacture and producing, with light aggregate, concrete of tremendous compressive strength. • "INCOR" is a High-Early-Strength Portland Cement which produces concrete ready to use in 24 hours. "INCOR"* contains no admixtures . . . requires no special methods of handling. It amply fulfills the requirements of the tentative specifications of the American Society for Testing Materials.

*Reg. U. S. Pat. Off.

"LONE STAR" and "INCOR" Cements
made and sold by

LONE STAR CEMENT COMPANY ALABAMA
LONE STAR CEMENT CO. INDIANA, Inc.
THE CUBAN PORTLAND CEMENT CORP.
LONE STAR CEMENT CO. PENNSYLVANIA
THE LONE STAR CEMENT CO. (KANSAS)
LONE STAR CEMENT CO. VIRGINIA, Inc.
LONE STAR CEMENT CO. NEW YORK, Inc.
LONE STAR CEMENT CO. LOUISIANA
ARGENTINE PORTLAND CEMENT CO.
LONE STAR CEMENT COMPANY TEXAS
URUGUAY PORTLAND CEMENT COMPANY

Subsidiaries of the
INTERNATIONAL CEMENT CORPORATION
342 MADISON AVENUE, NEW YORK, N. Y.

INTERNATIONAL CEMENT CORPORATION

Pile Extractors *that are not also* Pile Hammers

The Vulcan Pile Extractor is shown in action at the right. It is always ready for instant service. Picked up on a crane hook and attached to the pile—then it is ready to pound the pile *out*. Made in three sizes, for even longest, heaviest piles.

THE contractor is advised to purchase Vulcan PILE EXTRACTORS for just that *one* job. Do not buy them with the impression that they can be turned upside down and used for *driving* pile, too, or some other makeshift work.

As you perhaps know, the Vulcan Pile Extractors are the first genuine *Extractors* to be built in this country.

Their cost is very moderate and they pull piling so economically and with so little fuss, the contractors are all beginning to agree with us that one of these Vulcan Extractors should be a part of every piling contractor's equipment.

Then for rapid, trouble-free *driving* of piling use a Warrington-Vulcan PILE HAMMER, just as you probably have always done, through the years.

The Warrington-Vulcans are noted as "the hammers with the punch"—the real *punching* action. This means the exactly right, scientific adjustment of weight of hammer to height of fall, which drives piling faster without damage to piling or hammer.

Write for Descriptive Bulletins.

VULCAN IRON WORKS

327 No. Irving Avenue, CHICAGO, ILLINOIS

Southern Representatives:
Woodward, Wight & Co., Ltd., 451 Howard Avenue, New Orleans, La.
Representatives for California, Nevada, Japan:
Harron, Rickard & McCone Co., 1600 Bryant Street, San Francisco, Calif.
Representatives for the State of Washington:
A. H. Cox & Co., Inc., 1757 First Avenue, S., Seattle Washington

WARRINGTON -VULCAN

Some famous du

and the uses to which they are adapted

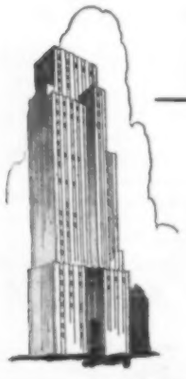
(A handy chart well

USES	"B" BLASTING POWDER	DUROX	DU PONT EXTRA	RED CROSS EXTRA
Clay Mining (Open)	1st Deep Sprung Holes	1st	2nd D-H	1st
Clay Mining (Underground)	3rd	1st	2nd D-H	2nd 20%-40%
Excavating for Foundations	2nd Deep Sprung Holes Clay and Shale	2nd	3rd	1st 20%-40%
Gypsum Mining	0	2nd	3rd	2nd
Open Pit Mining	1st Deep Sprung Holes Soft Material	2nd	?	1st 20%-60%
Ore Mining (Underground)	0	3rd	2nd	2nd
Quarrying	2nd Tunnel Blasts	2nd Soft Limestone	1st Shale and Soft Limestone	1st Shale and Soft Limestone Also Tunnel Blasts
Roads and Railroads	1st Deep Sprung Holes Soft Material	?	?	1st 20%-60%
Salt Mining	0	1st	1st	3rd
Tunnels and Drifts	0	0	?	3rd

1st, 2nd, 3rd, 4th—Order of preference. 0—Should never be used.

The chart shown above is designed to help you select explosives which will give the best results in proportion to costs. Eight well-known du Pont explosives . . . and the chief kinds of blasting to which they are adapted . . . are given in the table. There are other du Pont explosives that can be used for some of the blasting work mentioned, but these eight give an excellent coverage for the particular fields.

When you specify du Pont explosives for the jobs you undertake, you specify explosives into whose making has gone more than a century and a quarter of experience. With du Pont explosives you are assured of satisfactory execution. For each du Pont explosive has been made, after thorough chemical research and study, to do the most efficient work in the blasting operation for which it is intended.



E. I. DU PONT DE NEMOURS & CO., Inc. ***Explosives***

DU PONT
REG. U. S. PAT. OFF.

DU PONT
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Pont explosives

other than coal mining and agriculture worth your saving)

DU PONT GELATIN	DU PONT SPECIAL GELATIN	DU PONT QUARRY GELATIN	STRAIGHT DYNAMITE
?	?	?	?
?	?	0	?
2nd Rock Only	2nd Rock Only	2nd Rock Only	3rd Rock
1st–20%	1st–35%	0	1st–20% L. D.
?	3rd Wet Holes	3rd Wet Holes	3rd
1st	1st	0	4th
2nd Granite and Hard Limestone	2nd Granite and Hard Limestone	1st Granite and Hard Limestone	2nd Granite and Hard Limestone
2nd Very Hard Rock Only	2nd Very Hard Rock Only	1st Very Hard Rock Only	3rd
4th	?	?	?
1st	1st	0	?

?—Can be used but is not recommended.

DU PONT
REG. U.S. PAT. OFF.

Department **WILMINGTON, DEL.**

Quick facts about these eight du Pont explosives

♦

"B" BLASTING POWDER. A deflagrating explosive made in seven standard granulations, of uniform size grains, and the railroad granulation which is a mixture of several sizes of grains. In material to which blasting powder is adapted it is probably the most economical explosive to use. Can be used only in dry work as it is readily affected by water.

♦

DUROX. An ammonia dynamite of low density and high velocity. Fumes are good. Its high cartridge count . . . 160 sticks to the case . . . makes it economical to use. Suited for blasting salt, limestone and gypsum.

♦

DU PONT EXTRA DYNAMITE. Low-density ammonia dynamite. Made in five types, all of them the same weight strength but varying in density and bulk strength. Strengths from 20% to 55%. Fumes are less objectionable than Red Cross Extra.

♦

RED CROSS EXTRA DYNAMITE. Probably the most popular high explosive on the market. Made in strengths from 15% to 60%. 102 to 106 sticks to the case.

♦

DU PONT GELATIN. Especially adapted for close work where ventilation is poor. Gives minimum of obnoxious fumes. Highly water resistant. Is plastic and loads solidly in bore holes.

♦

DU PONT SPECIAL GELATIN is similar in most respects to du Pont Gelatin except that it is not quite so water resisting and not adapted for very wet work. Its fumes have a different flavor from du Pont Gelatin, but are no more obnoxious.

♦

DU PONT QUARRY GELATIN. A type of gelatin dynamite developed especially for open work where the nature of the fumes is not important. It has same density, plasticity and water-resisting qualities as regular gelatins . . . and is stronger, grade for grade. Cannot be used in close work. Excellent for all kinds of outside work.

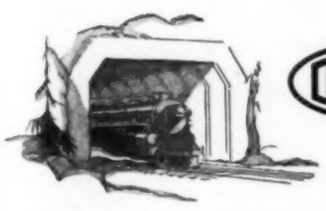
♦

DU PONT STRAIGHT DYNAMITE. The type of high explosive from which all others are graded. Is the quickest acting and most sensitive of them all, is highly water resistant and is the best explosive for mudcapping and propagated shots. It is not adapted for use in sprung holes owing to its sensitiveness, nor in close work, as its fumes, especially in the higher grades, are likely to be too obnoxious.

All above explosives are low freezing

♦

BLASTING ACCESSORIES. To fire the different explosives in the great variety of ways in which they are loaded requires efficient blasting accessories. The du Pont Company makes a complete line of these. Specify du Pont blasting accessories when you order explosives.



DU PONT
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DU PONT
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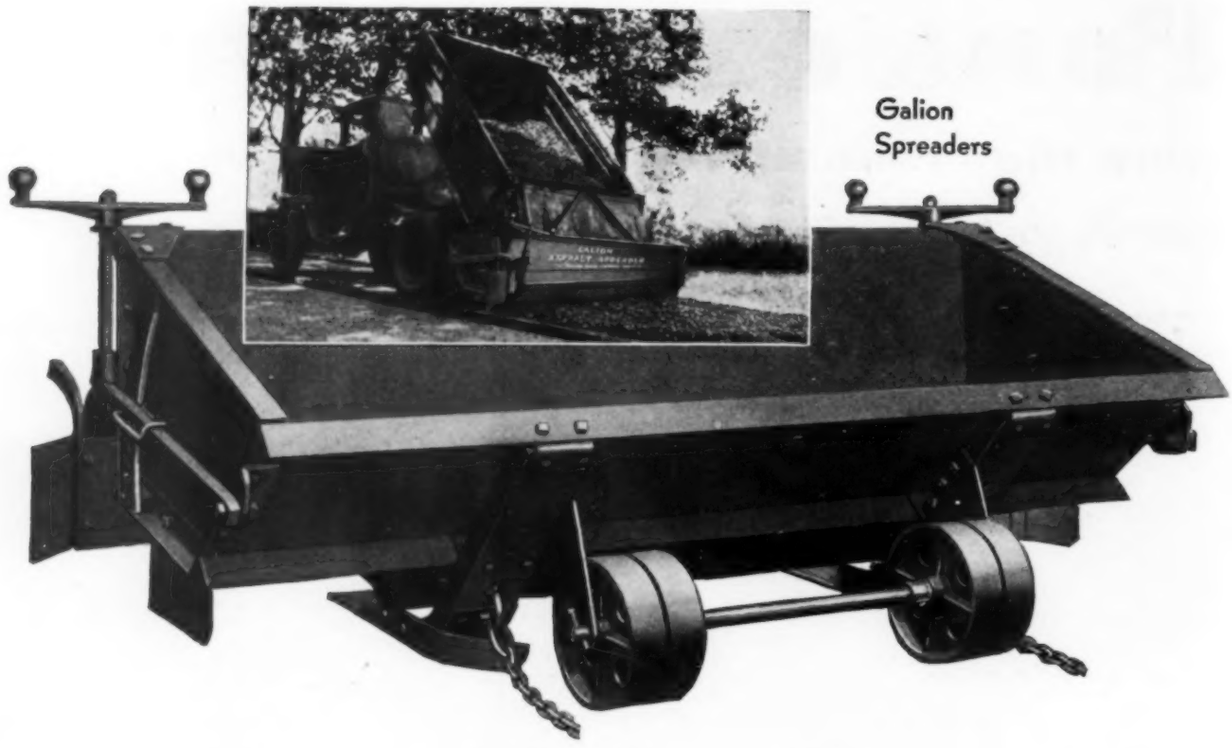


Galion
Spreaders

Smooth and Even Spreading

for Asphalt · · Stone · · Gravel · · Slag

Galion Spreaders can spread material in an even layer of any desired depth. Screw adjustment for depth of strike-off plate, easily operated even while spreading.

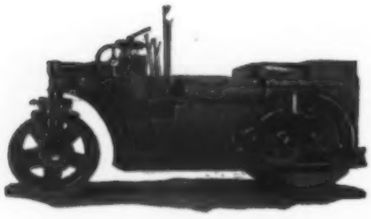
Notice how evenly Asphalt is being spread in the photograph above. Ready for the roller immediately without unnecessary hand shoveling and raking.

The spreader is placed behind a truck and chains attached. As the truck moves forward, dumping its load slowly, the spreader lays the material smoothly and evenly.

Two 8-foot spreaders will spread an 18-foot course or two 9-foot spreaders will spread a 20-foot course. Adjustable cut-off plates are furnished for less than 18-foot roads.

Double wheels and long shoes under spreader assure an even course and prevent it cutting into sub-grade.

Galion Spreaders are strong and sturdy, practical and efficient. Write for particulars.



Galion makes a roller for every job. Tandem type shown above.

The Galion Iron Works & Mfg. Co.

GALION · · · · OHIO

Galion Distributors

W. A. Adams Tractor & Equip. Co., Raleigh, N. C.
R. S. Armstrong & Bro. Co., Atlanta, Ga.
O. B. Avery Co., St. Louis, Mo.
Badger Tractor & Equip. Co., Milwaukee, Wis.
W. D. Banker Road Machy. Co., Memphis, Tenn.
Banks-Miller Supply Co., Huntington, W. Va.
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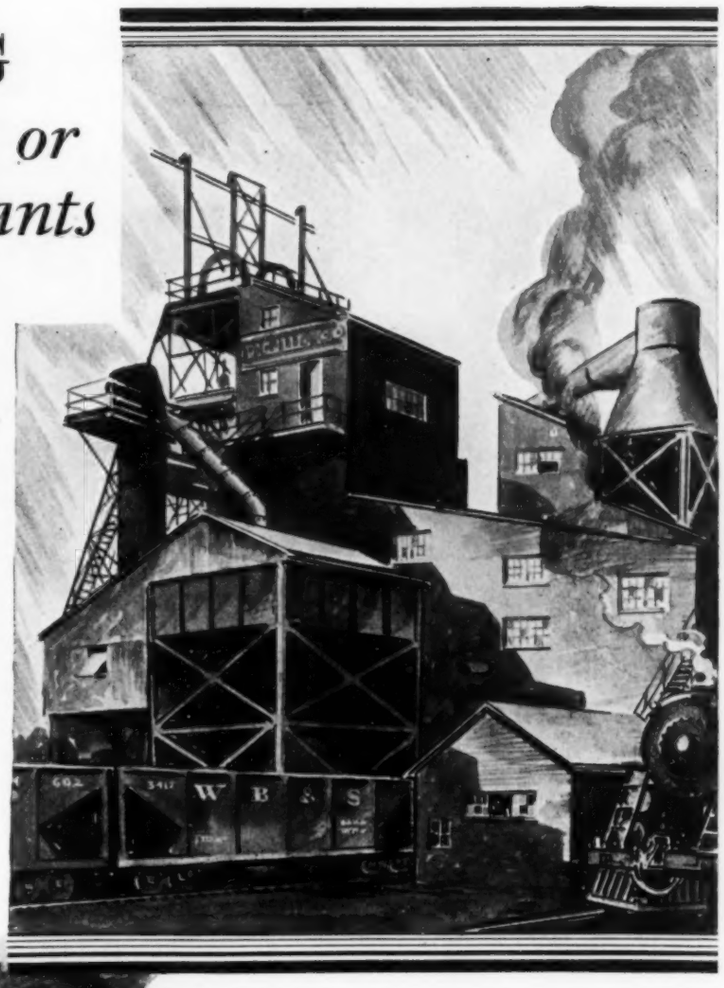
Brown-Fraser & Co., Ltd., Vancouver, B. C.
Dukehart Machy. Co., Des Moines, Iowa
Eastern Tractor Co., Cambridge, Mass.
Feenaughty Machy. Co., Portland, Ore.
Frankfort Equip. Co., Frankfort, Ky.
Good Roads Machy. Co., Inc., New York, N. Y.
Hall Perry Machy. Co., Butte, Mont.
Herd Equip. Co., Oklahoma City, Okla.
Interstate Machinery & Supply Co., Omaha, Nebr.
Jeffrey Mfg. Co., Ltd., Montreal, Que.
Jenison Machy. Co., San Francisco, Cal.
C. H. Jones Co., Salt Lake City, Utah
Lewis-Patten Co., San Antonio, Texas
Lewis Tractor & Machinery Co., Fargo, N. D.
Miller & Requarth, Springfield, Ill.
Morrow Auto Co., Albuquerque, New Mexico
H. W. Moore Equip. Co., Denver, Colo.
Morrisey Easton Tractor Co., Vicksburg, Miss.
Murphy & Murphy, Little Rock, Ark.
Northfield Iron Company, Northfield, Minn.
C. T. Patterson Co. Inc., New Orleans, La.
G. C. Phillips Tractor Co. Inc., Birmingham, Ala.
Power Equip. & Service Co., New Haven, Conn.
F. Ronstadt Co., Tuscon, Ariz.
Salina Tractor & Thresher Co., Salina, Kan.
Bert Smith, Enid, Okla.
Smith-Booth-Usher Co., Los Angeles, Cal.
Standard Road Equip. Co., Rockford, Ill.
W. H. Stoutenburg, Penn Yan, N. Y.
Tennessee Tractor Co., Nashville, Tenn.
P. E. Vaughn, LaCrosse, Kan.
Virginia Road Machy. Co., Richmond, Va.
Welch Good Roads Supply Co., Welch, W. Va.

FINANCING
Single Units or Complete Plants



IN the mines, and everywhere else, modern machinery is reducing operating costs. Obsolete and worn out equipment must be replaced. When budget restrictions forbid replacement it is not necessary to wait for an added budget appropriation to meet the situation. A Commercial Credit Plan will allow you to buy machinery and equipment of all kinds on a basis so liberal that increased earnings are made to pay the bill.

Write, today, for full information.

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Commercial Equipment Corporation, affiliation of Commercial Credit Companies, provides a further financing service to industry. Its method of financing complete installations as a unit, requiring two or more varying types and makes of equipment, has been approved and endorsed by many of the country's leading engineers.

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POWER AND TRACTION TO MOVE MORE DIRT

IT doesn't pay to handicap good equipment. Match it with POWER that can make it work—that can get *capacity*—that doesn't ask for half loads when the going gets difficult. Full loads pay the profits! And Cletrac power is designed for them — in good weather or bad — winter or summer — over the roughest footing or the toughest grades.

Cletrac power and sure-grip traction makes good equipment better. It permits scrapers to carry more and work faster. It permits blades to bite deeper. It moves more dirt ahead of bull-dozers. It scores with extra yards and more work done on any job you put it to.

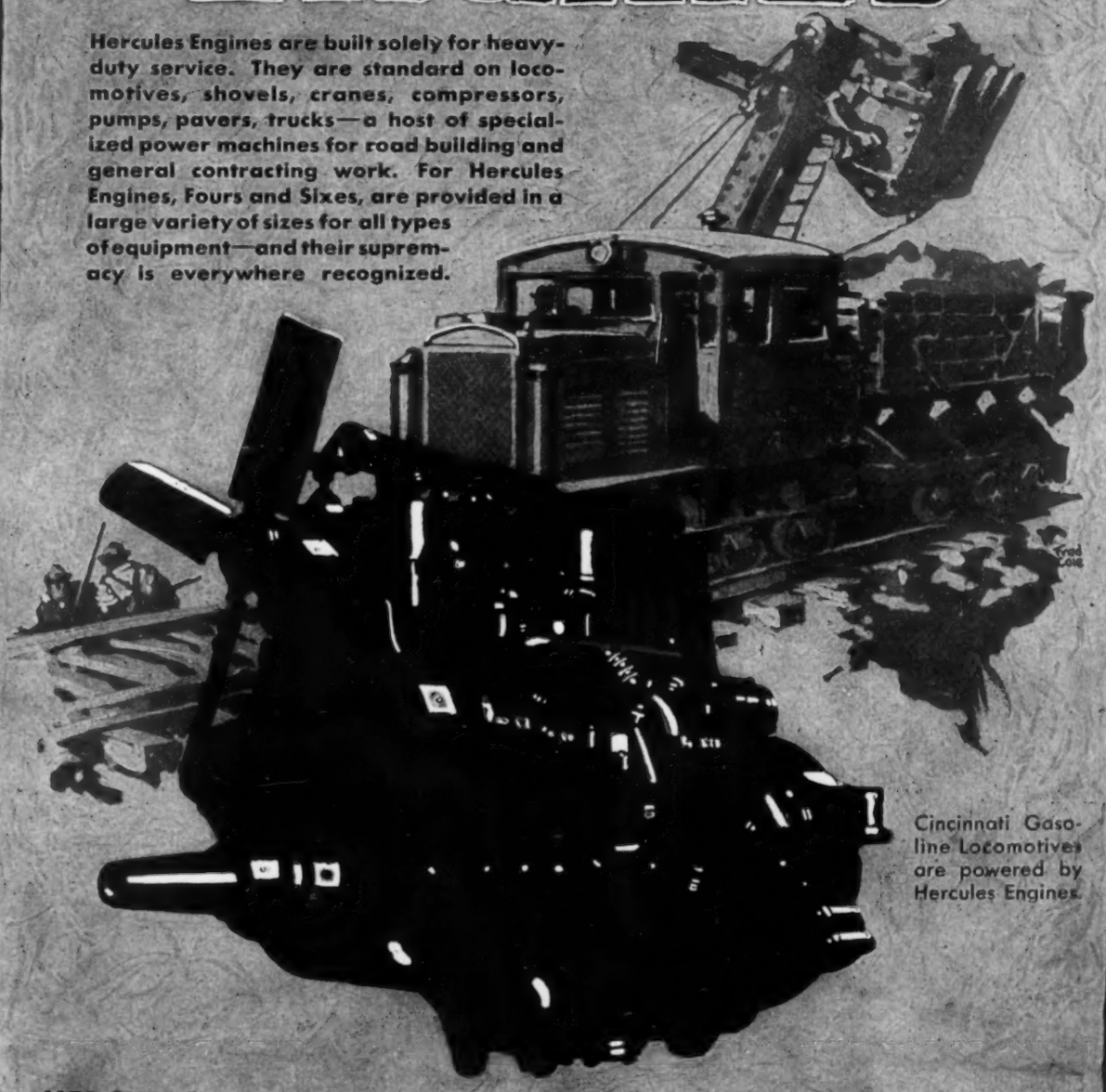
Cletrac
Crawler Tractors

Cletracs are built in five different sizes—twenty to one hundred horsepower—ranged to meet your power needs. Ask the Cletrac distributor near you to demonstrate, or write direct for complete literature.

THE CLEVELAND TRACTOR COMPANY
19323 Euclid Avenue Cleveland, Ohio

HERCULES ENGINES

Hercules Engines are built solely for heavy-duty service. They are standard on locomotives, shovels, cranes, compressors, pumps, pavers, trucks—a host of specialized power machines for road building and general contracting work. For Hercules Engines, Fours and Sixes, are provided in a large variety of sizes for all types of equipment—and their supremacy is everywhere recognized.



Cincinnati Gasoline Locomotives are powered by Hercules Engines.

HERCULES MOTORS CORPORATION, CANTON, OHIO, U. S. A.

West Coast Branch: San Francisco, Cal. **Mid-Continent Branch: Tulsa, Okla.**

Distributors, with Parts Depots: Smith-Booth-Usher Co., Los Angeles, Cal.; Edward R. Bacon, San Francisco, Cal.; F. C. Richmond Co., Salt Lake City, Utah; Worthington Machinery Corp., Tulsa, Okla.; Norvell-Wilder Hardware Co., Houston, Tex.; Boviard & Co., Bradford, Pa.

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G. C. M., Inc.

Keep Down *the* Detour Signs . .

GENUINE OPEN HEARTH IRON
TRADE GOHI MARK
PURE IRON - COPPER ALLOY
REG U.S. PAT OFF.

(Meet copper-bearing pure iron requirements in all accepted specifications for corrugated metal culverts.)

Corrugated Culverts

Installed Between Sunup and Sundown

KEEP the roads open — lower your drainage costs. In addition to unquestioned permanence, GOHI Corrugated Culverts offer the practical advantages of easy handling and quick installation.

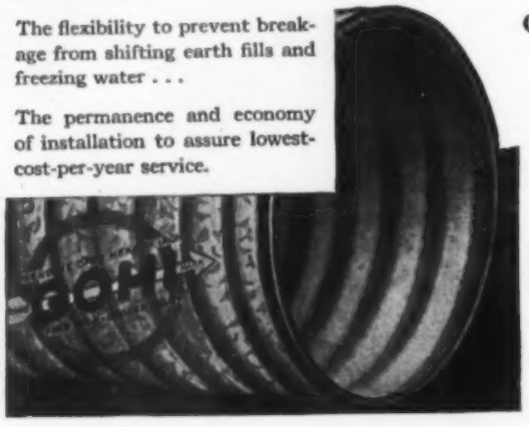
A GOHI Corrugated Culvert may be installed in less time and at lower cost than any other type of culvert. No heavy, expensive machinery needed. No delays. Simply dig the ditch, lay culvert in position backfill and resurface — the job's done. Quick, Sure, Safe.

GOHI Corrugated Culverts are made of Genuine Open Hearth Iron, pure iron-copper alloy. Metallurgical tests and more than twenty years of actual service prove that this material offers greater resistance to corrosion than any present-day culvert metal. Get all the facts — figure all the costs — you'll specify GOHI Corrugated Culverts.

GOHI Corrugated Culverts have the strength to stand up under all traffic conditions . . .

The flexibility to prevent breakage from shifting earth fills and freezing water . . .

The permanence and economy of installation to assure lowest-cost-per-year service.



GOHI CULVERT MANUFACTURERS, Inc., Newport, Ky.

Central Culvert Co.
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Denver Steel & Iron Works Co.
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A. N. Eaton, Metal Products
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Tennison Brothers
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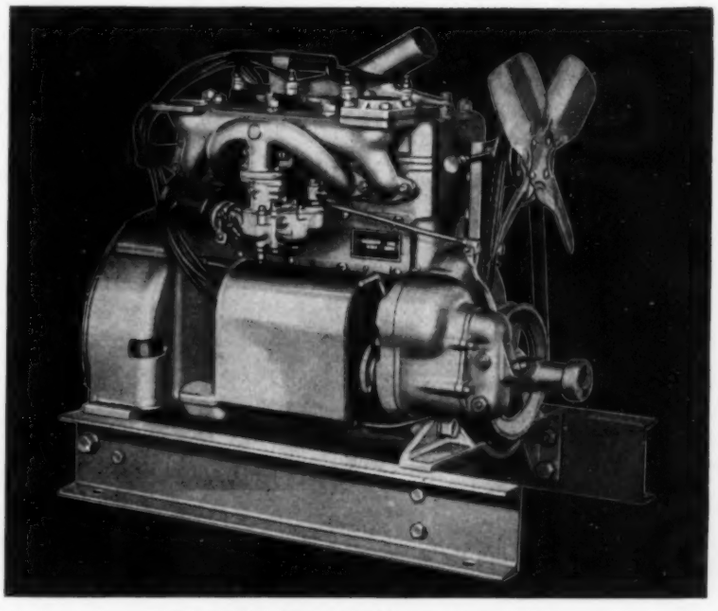
90 YEARS OF PIONEERING

NINE years before the "forty-niners" began their westward trek in quest of California's gold . . . the name "Fuller & Johnson" on machinery was a byword for quality.

Since its establishment in 1840, this company has been prominent in the pioneering and continuous development of farm and industrial machinery.

The opening of the present century found Fuller & Johnson pioneering in the field of the internal combustion engine. Their heritage from the past . . . that invaluable experience, not paralleled elsewhere in the industry, and that same purposeful spirit of pioneering perpetuate their ideal to build better engines . . . engines distinguished for power, stamina, economy and matchless performance in industrial service.

For information regarding Fuller & Johnson power units, write the Fuller & Johnson Mfg. Co., manufacturers of single and multi-cylinder . . . air and water cooled . . . horizontal and vertical engines, in various sizes. Address: 70 Coma Street, Madison, Wis.



Model BC, four-cylinder, 6-10 hp. engine

FULLER & JOHNSON

ENGINE SPECIALISTS ESTABLISHED 1840

MIX CONCRETE *in a* MORTAR BOX?

Of course not! You take every advantage of mechanical methods in all other types of work—

Then why be satisfied to do any of the thousand and one time-consuming, brain-fagging *figuring* jobs by hand?

Why not let the Marchant give you yesterday's costs today—estimates in half the time—reports figured almost before the jobs have happened—payrolls without drudgery—

ALL your figuring with absolute accuracy, without re-figuring or checking back.

MARCHANT PORTABLE *Calculator* $125

Adds
Subtracts
Multiplies
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Much faster, more flexible, greater capacity than your "slip stick" . . . Portable, light weight.

Anyone can run it.

Sold under the standard Marchant guarantee. Terms if desired. Sales and service offices the world over. Mail the coupon for full information.

17 years building calculators, nothing else . . Electric, hand operated and portable models . . as low as $125.

Free! Marchant Calculating Machine Co.
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Please send me full information about
☐ Marchant 100% Electric ☐ $125 Marchant Portable

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Address _____
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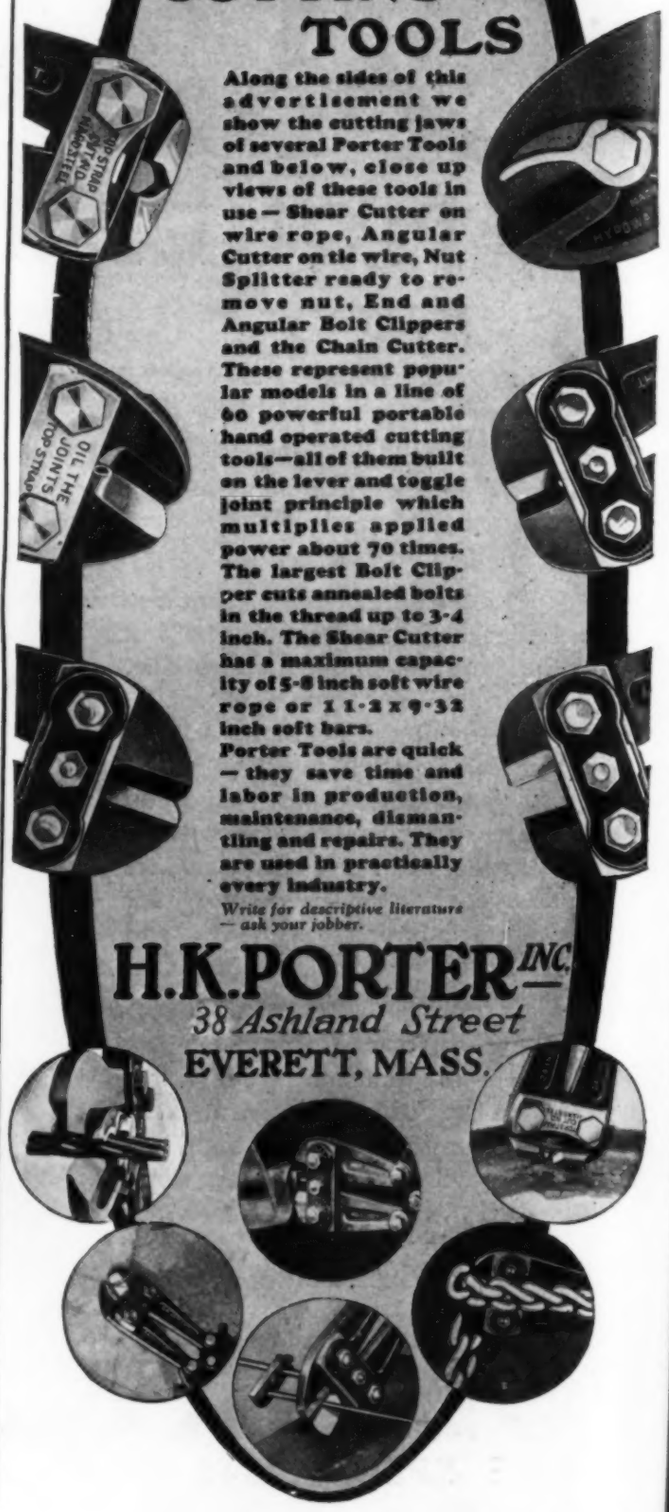
PORTER (HKP)

PORTABLE HAND OPERATED

CUTTING TOOLS



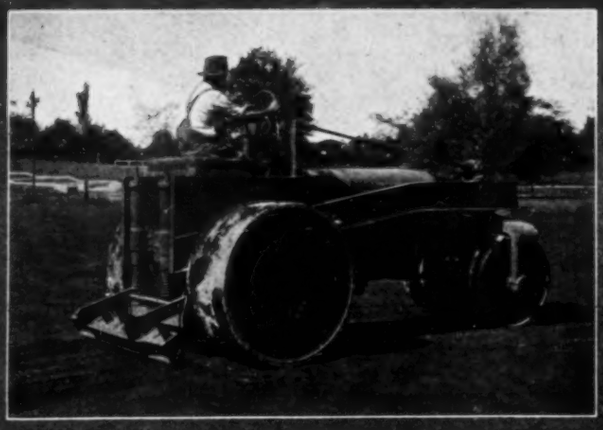
Along the sides of this advertisement we show the cutting jaws of several Porter Tools and below, close up views of these tools in use — Shear Cutter on wire rope, Angular Cutter on tie wire, Nut Splitter ready to remove nut, End and Angular Bolt Clippers and the Chain Cutter. These represent popular models in a line of 60 powerful portable hand operated cutting tools—all of them built on the lever and toggle joint principle which multiplies applied power about 70 times. The largest Bolt Clipper cuts annealed bolts in the thread up to 3-4 inch. The Shear Cutter has a maximum capacity of 5-8 inch soft wire rope or 1 1-2 x 9-32 inch soft bars. Porter Tools are quick — they save time and labor in production, maintenance, dismantling and repairs. They are used in practically every industry.

Write for descriptive literature — ask your jobber.

H.K. PORTER INC.

38 Ashland Street
EVERETT, MASS.

Wehr 3 to 7 Ton Road Roller



The New Wehr A-4 Grader

The Complete Wehr Line Builds and Maintains Good Roads and Good Profits

WEHR—The Pioneer—offers a line of road building and maintenance equipment that demands the attention of every highway man, township, county and state highway official!

For every road construction and maintenance project, there's a Wehr unit to fit the job. Wehr One Man Power Graders, especially the new A-4 and the improved U-4, offer a large number of engineering features procurable in no other grader. The Wehr 3 to 7 Ton Road Roller is famous for its ruggedness and durability, apparent in the massive construction of this highly adaptable unit. Wehr also offers a new and complete line of pull-type graders, designed and built to handle every type of road work.

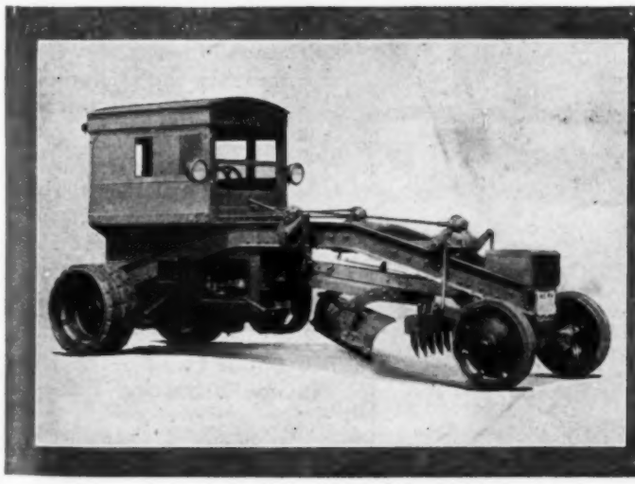
The development of the Wehr line is the result of the Wehr complete-service policy. A capable engineering staff, and a modern factory using up-to-date equipment, unite to produce road-machinery that is well-known throughout the world. Less cost and greatest production per mile of service are the results of Wehr construction, giving greater investment returns to the buyer of Wehr equipment.

Write for full details of the Wehr line, stating what equipment you are particularly interested in.

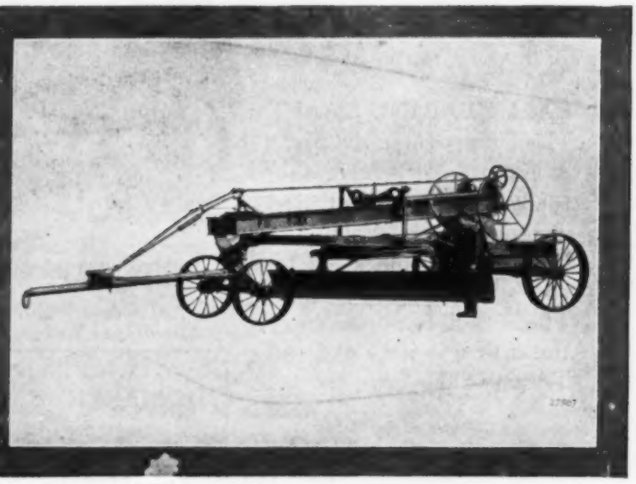
WEHR COMPANY, *Milwaukee, Wis., Factory: Cudahy, Wis.*

WEHR

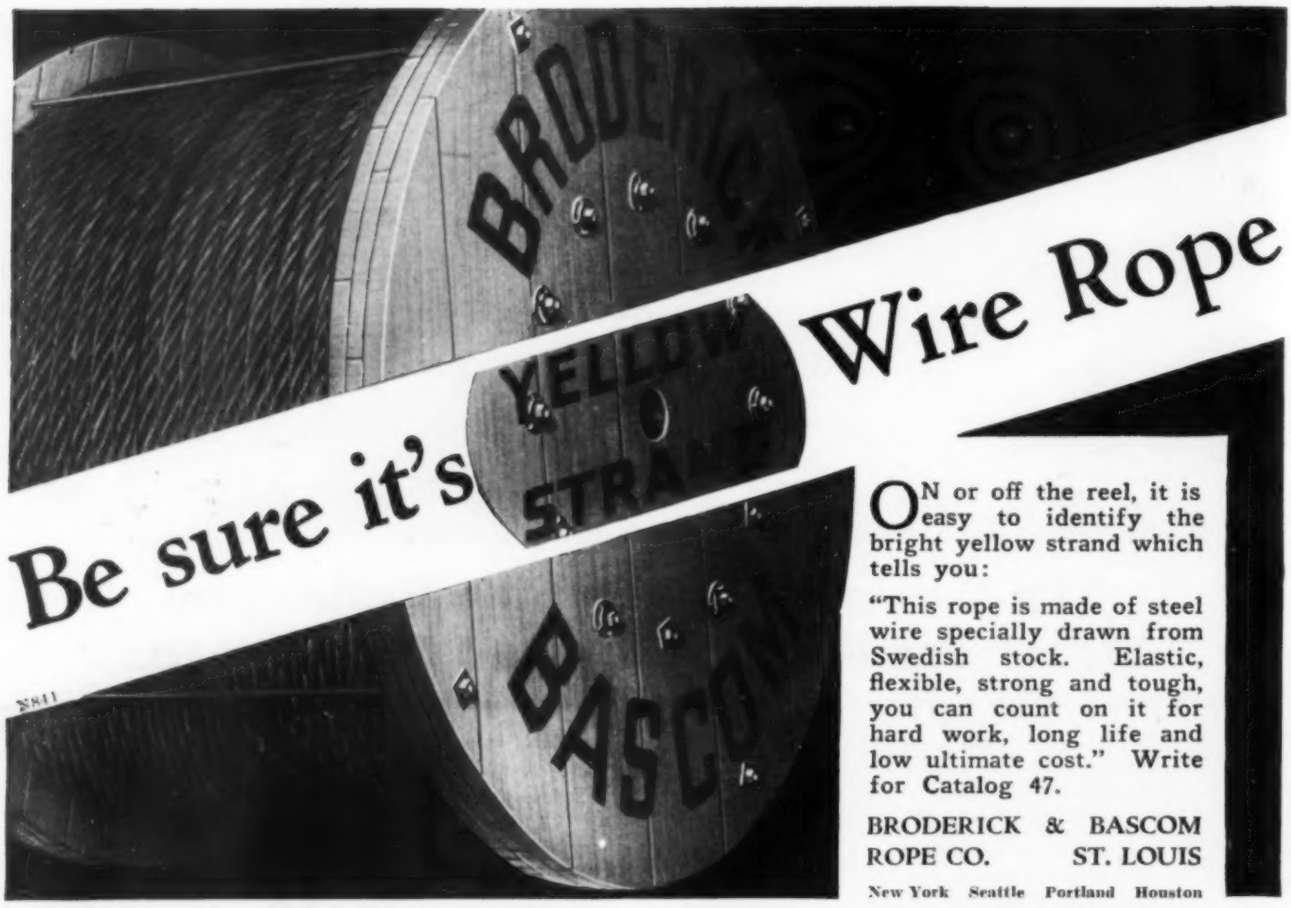
ROAD BUILDING AND MAINTENANCE EQUIPMENT



The Improved Wehr U-4 Grader



The New Wehr P-12 Pull-type Grader



ON or off the reel, it is easy to identify the bright yellow strand which tells you:

"This rope is made of steel wire specially drawn from Swedish stock. Elastic, flexible, strong and tough, you can count on it for hard work, long life and low ultimate cost." Write for Catalog 47.

BRODERICK & BASCOM ROPE CO. ST. LOUIS

New York Seattle Portland Houston

THE "DOMESTIC" CONTRACTORS' UTILITY PUMP

THE PRIMING DEVICE is positive, time-tested and proved.

A friction clutch on the vacuum pump and the regulator device gives both AUTOMATIC or MANUAL control PRIMING.

BALL BEARING SHAFT The Pump Impeller Shaft is exceptionally large (actually as large as that used in some 6-inch Centrifugal Pumps) and supported by two sets of Ball Bearings. These Ball Bearings carry the entire Radial Load and Thrust of the Impeller.

2½" Suction, 2½" Discharge

THE "UTILITY" PORTABLE PUMP
for
Contractors, Public Service Corporations and Municipal Water and Sewer Departments.

Write to-day for Bulletin VCU
DOMESTIC ENGINE & PUMP CO.
Shippensburg, Penna.

TRASH HANDLING IMPELLER

The Impeller is of Special Design and has wide, open passages that permit a spherical ball of 1 3/16 inches to readily and freely pass through the pump.

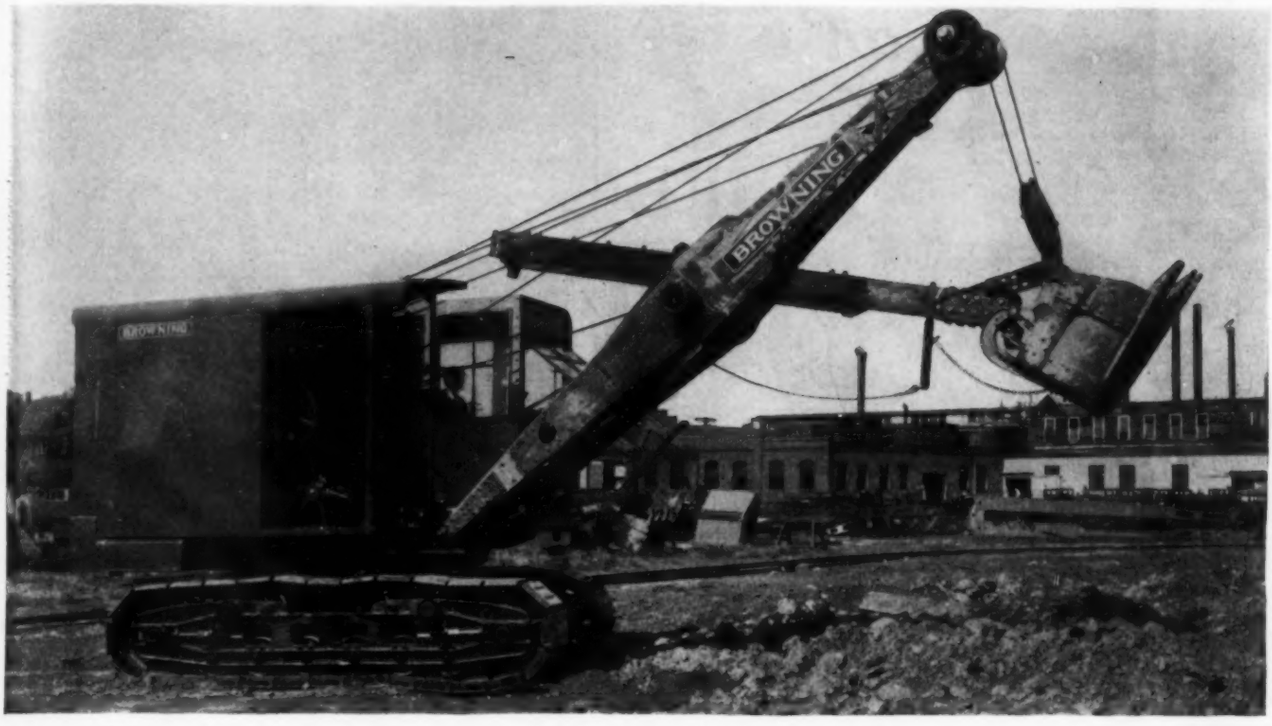
For pumping trash-infested water as found in manholes, catch-basins, sewers and trenches the ability of this pump to handle solids is much in its favor.

CAPACITY: On a 20 ft. Total Head, when suction Total Lift is not over 10 ft., this little pump has a delivery of 200 gallons per minute.

Maximum Head — 60 ft.
Maximum Suction Lift— 27 ft.

SMALL IN SIZE BUT GREAT IN STRENGTH AND CAPACITY

BROWNING



5/8 Yard Shovel combines speed with exceptional digging power—a combination which means profitable earth moving... Let us send you complete details.

THE BROWNING CRANE COMPANY
16226 Waterloo Road **CLEVELAND, OHIO, U. S. A.**

Branch Offices:
50 Church St., NEW YORK, N. Y. **122 S. Michigan Ave., CHICAGO, ILL.**

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Iron Mules can't JACK-KNIFE

Other Hughes-Keenan Products

1 and 1½ - yard gravity, hand and power hoist dumps for standard trucks, also Roustabout tractor cranes. The new Hughes - Keenan Power Glider Dump — a mechanical power hoist body that's unusually low in price and which embodies a new and remarkably efficient dumping action, is 1930's most remarkable dump body. Check coupon below, if you would like literature describing these.

"IRON MULES" never have to be eased along like draw-bar dirt movers. There's no fear of them jack-knifing. They're self-contained tractor dumps. They haul as big daily yardages in mud and boulder-ridden going as on concrete.

On scores of occasions, when draw-bar dirt movers couldn't move without jack-knifing and wrecking themselves, "Iron Mules" went in and proved no going could tie them up. They're fast, powerful and adaptable. 2 and 4-yard tractor dumps that build their own roads as they go and dump over fills without having to back up.

There are hundreds in use. Lots near you. See them in action. Mail coupon for folder that describes these short-haul dirt movers with front end drive.

THE
HUGHES-KEENAN COMPANY
MANSFIELD, OHIO

HUGHES-KEENAN
IRON MULE
TRACTOR DUMP
MOUNTED ON MODERN TRACTORS

The Hughes-Keenan Company, Mansfield, Ohio: 3

Please send your free illustrated literature checked.
"Iron Mule" Folders ☐ Dump Body Catalogs: Ford ☐
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Name .....

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If interested in

Hoists,
Derricks,
Cableways

or special equipment write for this book

"Your Own Success"

Good tools and good equipment are essential to success. Lidgerwood machines have success built in them.

Lidgerwood Manufacturing Company

ELIZABETH, NEW JERSEY

Hoist and Derrick Headquarters
for 57 years.

SWIVEL BASE COMBINATION PIPE AND STANDARD VISE!

The handy tool of a thousand uses. Machinists' Vise and Pipe Vise, both in one, should be included in every contractor's tool box. Holds object of *any shape* at *any angle!* Think what that means!

Either set of jaws can be used on top or at *any angle*. A great time and space saver.

Husky construction—best material—heat treated jaws—highly finished. Satisfaction guaranteed.

Use Coupon!

Yes, you can quote me on the NuTYP Vise and on other Oswego Tools, also send me your catalog.

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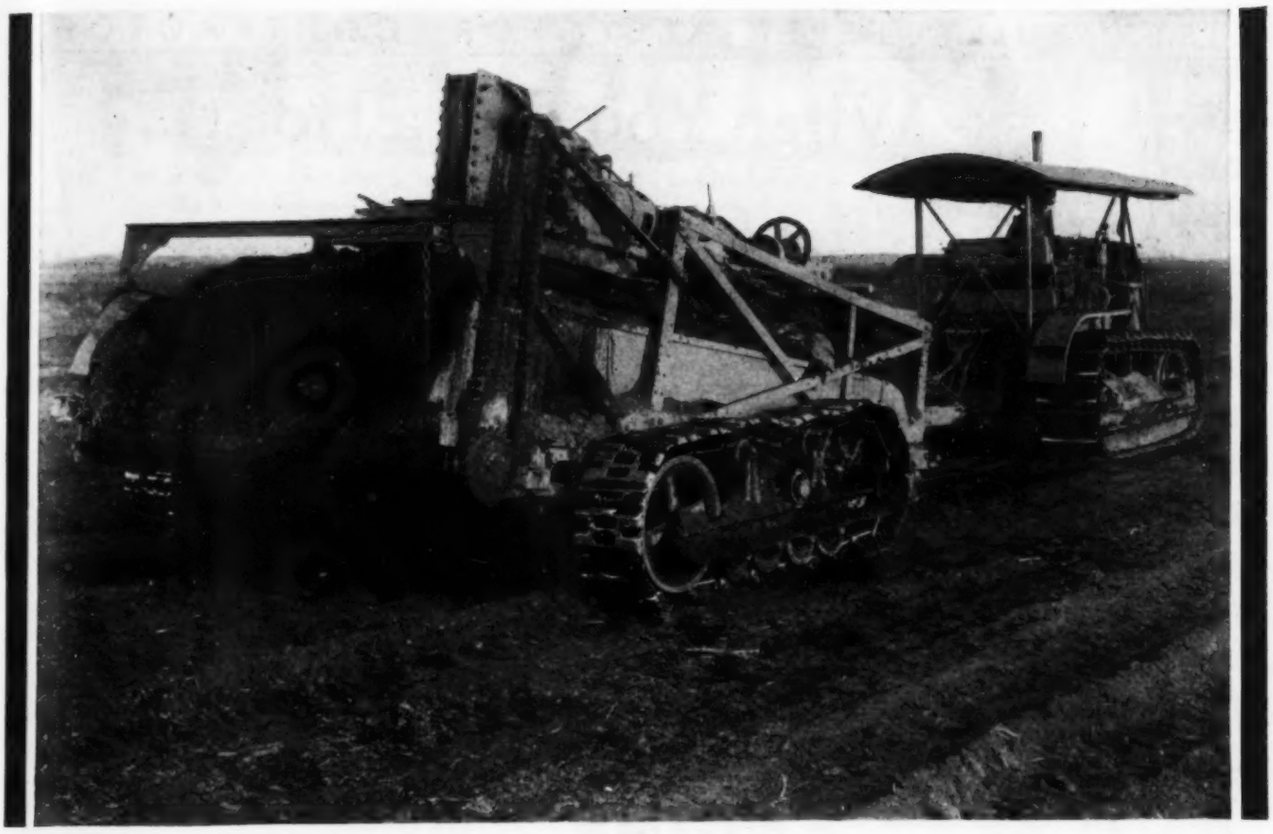
Kind of Business .....

B-906

THE OSWEGO TOOL CO.
Oswego, N. Y.
Since 1887



WHOLESALE earth moving

TWELVE CUBIC YARDS—electrically operated—one man drives tractor and operates leveler! Here's a "Caterpillar" Sixty pulling a new kind of earth-mover developed and used by Guy Brothers. It is typical of new equipment that alert manufacturers are putting on the market—big, rugged wagons and scrapers and bull-dozers that convert the extra power and extra traction of "Caterpillars" to extra yardage and extra profits.

Prices—f. o. b. Peoria, Illinois

TEN	$1100	TWENTY	$1900
FIFTEEN	$1450	THIRTY	$2375
SIXTY	$4175		

Caterpillar Tractor Co.

PEORIA, ILL. *and* SAN LEANDRO, CALIF., U. S. A.

Track-type Tractors Combines Road Machinery

(There's a "Caterpillar" Dealer Near You)

CATERPILLAR
REG U.S. PAT. OFF.
TRACTOR

HOISTS BUILT ESPECIALLY FOR CONTRACTORS

DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE

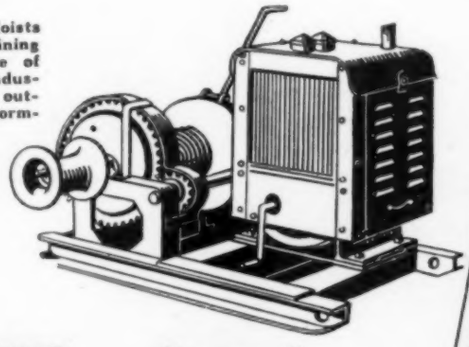
When You Buy a Hoist...

When you buy a hoist you will want to buy one that is light for easier and faster portability, that is strong, sturdy and correctly designed for long dependable service under the most severe conditions, and that is low in price.

We have made a definite effort to build these features into Dake S-LG Hoists. Investigation will convince you that we have succeeded.

If you need a hoist of from 2 to 27 H.P.—Gasoline or Electric Driven, it will pay you to investigate Dake Hoists. Write us today asking for a copy of our new illustrated catalog.

DAKE S-LG Hoists are rapidly gaining the acceptance of the building industry by their outstanding performance.



DAKE ENGINE COMPANY
Grand Haven Michigan

DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE

A Dobbie Winch For Every Purpose

From 100 to 50,000 Pounds on a Single Line With Ease and Safety

Large Stock to Choose From

Dobbie Motorized Winches

Sizes 500 to 3000 pounds on a Single Line

DOBBIE FOUNDRY & MACHINE CO.
Niagara Falls, N. Y.

Complete Stock Carried at Niagara Falls and New York City

Timber Derrick Fittings—Sheaves—Hand-Winches—Blocks

Write for prices, Dobbie all steel Derricks and Rotating Derricks.

KOLESCH TILTING LEVEL

No. 7850

$90

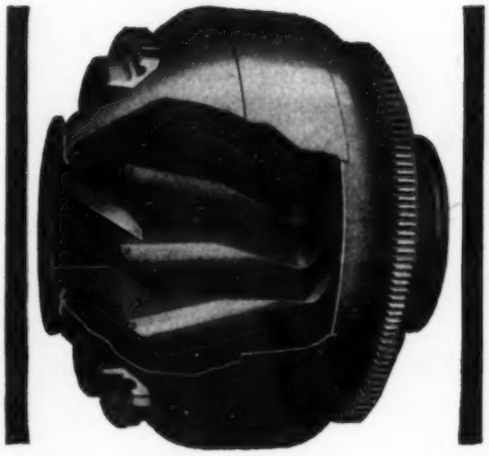
12-in. Telescope. Shifting Center. Trunnions in one piece. Sold with our Guarantee that it is the Best instrument of its kind.

Write for Illustrated Catalog.

KOLESCH & CO., 138 Fulton St., N. Y.

MULTI FOOTE PAVER

And Its 100% MIXING DRUM



For over twenty years the Foote double cone drum has been a distinctive feature of Multi-Foote Pavers. It has three important advantages:

Even Running, due to the load being carried at all times at the center of the drum.

Fast and Effective Mixing, which results from its natural tendency to throw the batch from each end toward the middle of the drum.

A Natural Scouring and Cleaning Action—Concrete has little chance to accumulate or clog in a MultiFoote mixing drum. There are no corners as in a cylinder drum. This is very important where early strength cements or calcium chloride is being used.

Each drum roller in the 27E is mounted on two Timken bearings of the size ordinarily used in the rear end of a five-ton motor truck.

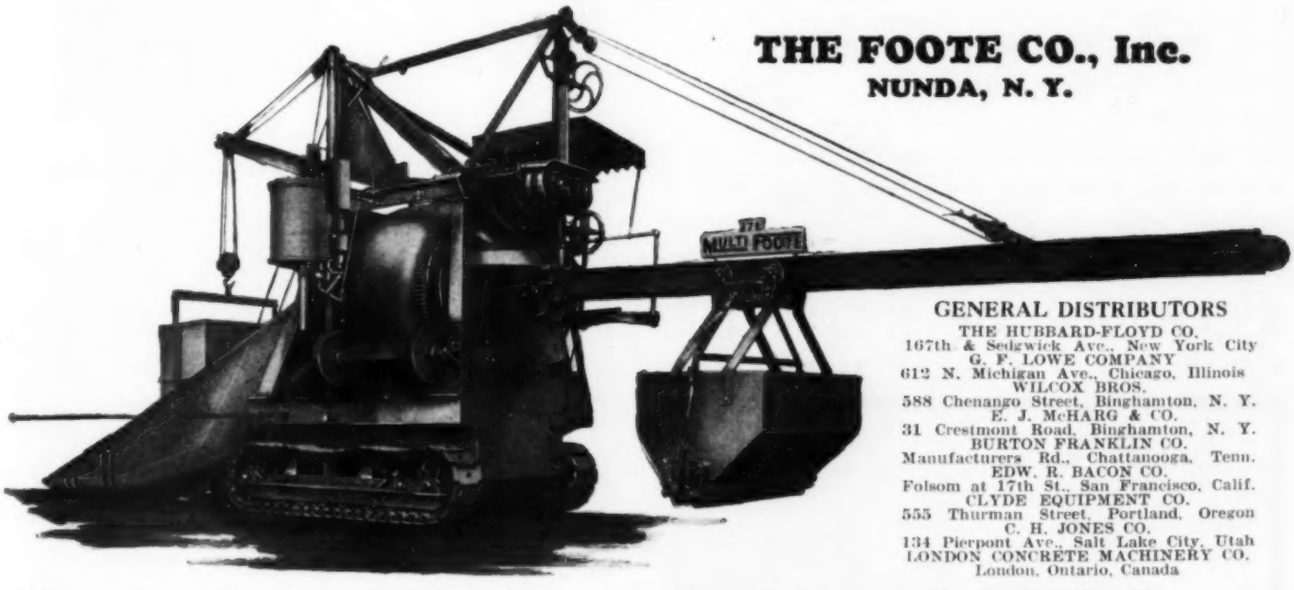
100% Perfect Mixing Action

No Clogging or Building up of Concrete.

Result of 26 Years of Constructive Engineering

Built by Specialists in the Paving Mixer Industry for the most severe tests of Road Paving. Dependable for mile-after-mile, day-after-day, steady, uniform service.

THE FOOTE CO., Inc.
NUNDA, N. Y.



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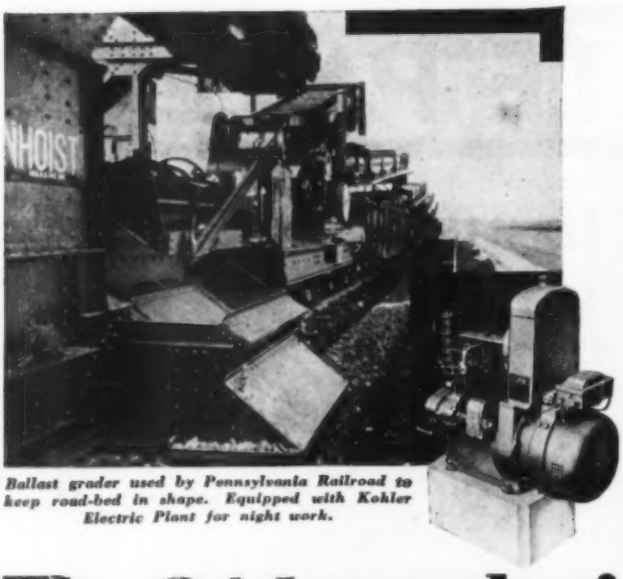
LONDON CONCRETE MACHINERY CO.
London, Ontario, Canada

World's Largest Exclusive Builders of Road Pavers



Ballast grader used by Pennsylvania Railroad to keep road-bed in shape. Equipped with Kohler Electric Plant for night work.

The 24-hour day!

THIS ballast grader is used by the Pennsylvania Railroad to maintain road-beds over which many of the world's fastest trains run daily. Assisted by spotlights from a Kohler Electric Plant, the crew works in the night hours when traffic has slowed up.

Railroad men and construction engineers appreciate the economies made possible through efficient lighting of night work. On work trains, in mining camps, in oil-fields, *everywhere*, Kohler electricity is regularly on the job. A source of sure and steady electric current whenever and wherever needed.

Kohler Electric Plants generate current at 110 or 220 volts D. C. or A. C. They range in capacities from 800 watts to 10 K. W. Their operation is smooth and sure—as silent as a fine motor-car. All models are compact, rugged and readily transportable. They run without storage batteries. Current is turned on the moment you push any switch in the circuit. For complete information answering your specific needs, send the coupon below. Kohler Company. *Founded* 1873. Kohler, Wis.—*Shipping Point*, Sheboygan, Wis.—*Branches in principal cities*. . . . Manufacturers of Kohler Plumbing Fixtures.

KOHLER OF KOHLER

ELECTRIC PLANTS

CM—7-30

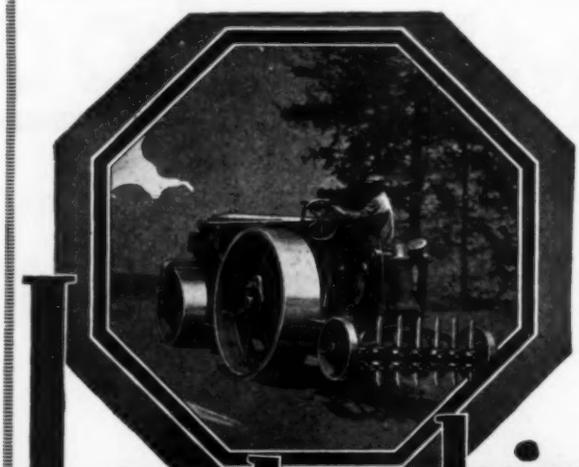
KOHLER CO., Kohler, Wisconsin

Gentlemen: Please send catalog describing Kohler Electric Plants.

*Name*_____ *Street*_____

*City*_____ *State*_____

*Use in which interested*_____



Leadership

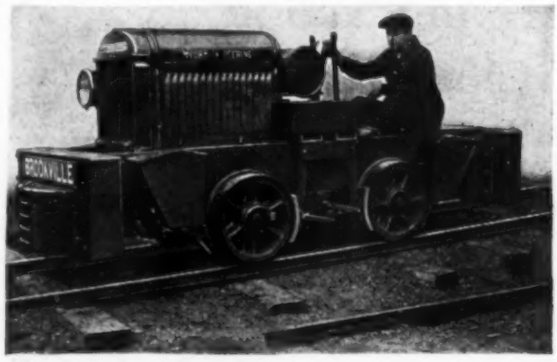
It is to the men already using Buffalo-Springfield Rollers that we direct you for a frank, unbiased opinion of their practical worth. They, of all men, can best explain why the Buffalo-Springfield is, and long has been, the leader among road rollers.

Various models, steam and motor-driven. All practical sizes. Scarifier and other attachments when desired. Booklet upon request.

THE BUFFALO--SPRINGFIELD ROLLER CO.

Springfield, Ohio

Buffalo—Springfield Rollers



Sound Reasons for the Superiority of Brookville Locomotives

1. They are powered with high-grade power units, manufactured by the foremost makers of trucks and tractors—Ford, Fordson, McCormick-Deering, etc. Low in price, dependable, efficient.
2. The Brookville Chassis is designed to utilize engine and accompanying clutch and transmission without alteration, making expert and economical service available from all Ford or McCormick-Deering (International Harvester Co.) representatives.
3. The simple Brookville Reverse Drive makes all forward speeds available in reverse.
4. The heavy steel Brookville Chassis is practically unbreakable. The perfected Brookville Chassis powered with its high grade popular motor makes a low priced combination that is hard to beat, in any respect.

Sizes: 2 to 12 tons—Send for Literature.

BROOKVILLE LOCOMOTIVE COMPANY

BROOKVILLE, PA.

No. 7

Cut Out the Time-Wasting Motions of Nut Turning

By Using the

FAVORITE reversible ratchet WRENCH

It turns nuts with the quick ratchet movement that avoids the time-wasting motions of the old style open end wrench that has to be removed from the nut several times before operation is completed.

Slipping from the nut is avoided by the socket form of head that encompasses nut on all sides with an equal pressure.

The Up-to-Date Method of Turning Nuts—Use a "Favorite" Wrench

Many contractors use the "Favorite" Wrench especially where time is an important item on the contract.

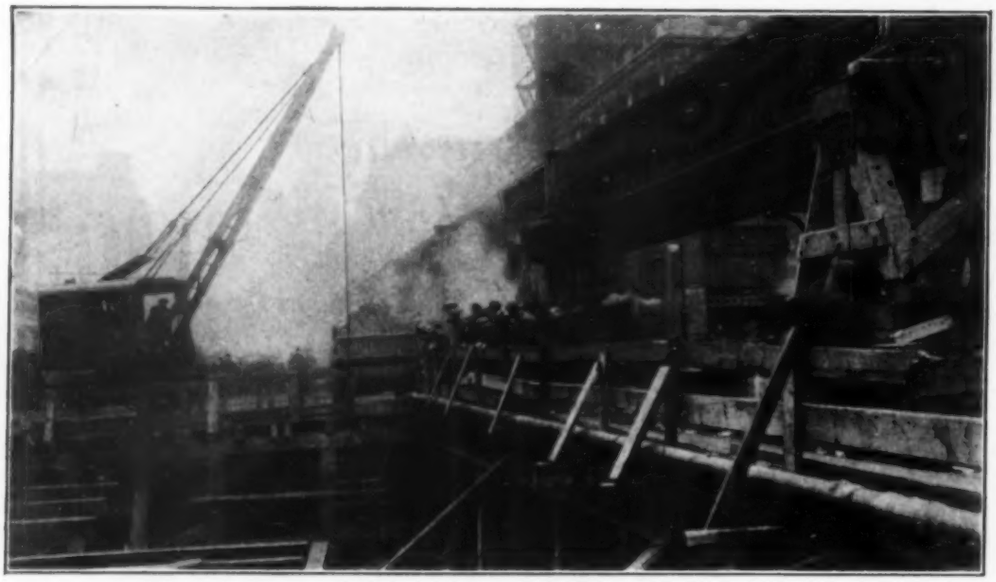
Write for full particulars.

GREENE, TWEED & CO.

Sole Manufacturers

109 Duane St. **New York**

BUILT STRONG FOR ROUGH USAGE



AT CHURCH AND VESEY STS., NEW YORK

An elevated railway above.

Street cars and traffic on the surface.

The B.M.T. subway below.

The fifty-foot excavation for the new subway had to go underneath all these at this point. Red Clayey Quicksand.

The Underpinning Co., of New York, were the contractors. They can handle hard jobs, but a FOUR-PUMP MORETRENCH WELLPOINT SYSTEM made this one a little easier for them. Their Mr. Dykeman says:—"We are very glad to endorse your Wellpoint System, which we have used very successfully on our subway contract. Your advice and service from your many years' experience are of great value to any contractor who has a de-watering problem that might retard his work." Thank you, Mr. Dykeman!

THE MORETRENCH WELLPOINT SYSTEM MAKES EVERY JOB A DRY JOB!

Moore Trench Machine Co., Rockaway, N. J.

Get
YEARS
AHEAD
with the-
BUHL
PORTABLE
AIR COMPRESSOR
The latest improvements, exclusive to the BUHL, insure the lowest possible compressed air cost and greatest freedom from shutdowns.
Buhl Portable Compressors are made in 36, 55, 90, 110, 220, and 330 cu.ft. capacities.
Please Write for Descriptive Literature
The Buhl Company
Old Colony Bldg.
CHICAGO

2 men do the work of 8
—this faster way of cutting heavy timber
These dock builders will tell you what they think of Timber Wolf Portable Sawing Machines. Approximately 4,000 timber piles were cut on the dock shown. Two men with the Timber Wolf Saw averaged twenty-five 16 in. to 23 in. old growth yellow fir piles per day—4 to 5 times as many as two men with a hand-saw! Two men doing the work of 8 means profits to you. Write for other interesting Timber Wolf figures.
A.C. or D.C. drive, or Compressed Air drive for under-water service.
REED-PRENTICE CORPORATION, Worcester, Mass.
Agents in Principal Cities
Detroit Office: 3-245 General Motors Building
New York Office: Room 715, 41 Broad Street
Atlanta, Georgia, Yancey Bros., Inc. Baltimore, Maryland, D. C. Elphinstone, Inc. Chicago, Illinois, Mr. B. E. Hurlbut, 223 Railway Exchange. Cleveland Ohio, W. M. Pattison Supply Company. Houston, Texas, Mr. T. G. Frazee. Kansas City, Missouri, English Brothers Machinery Co. Los Angeles, California, Shaw-Palmer-Bakewell Co. Mobile, Alabama, McGowin-Lyons Hardware & Supply Co. New Orleans, Louisiana, C. T. Patterson Company, Inc. Norfolk, Virginia, Lewter F. Hobbs, Inc. Wilkes-Barre, Pennsylvania, Ensminger & Co. Pittsburgh, Pennsylvania. A. H. Krigger & Co. San Francisco, Calif., Stephen Smith & Co. Seattle, Washington, P. Stinnes & Co. St. Louis, Missouri, Mr. T. B. Fitzwilliam. St. Paul, Minnesota, Borchert-Ingersoll Company. Philadelphia, Pennsylvania, Howard W. Read, Corp.

BONUS or PENALTY?

LINN Tractors are helping

Contractors to increase profits

Patent No. 1,270,531
Patent No. 1,521,454
Patent No. 1,685,641
Patent No. 1,688,676
Patent No. 1,701,979
Other Patents Pending

When "Old Man Weather" has turned dry earth to muck and mire . . . when other hauling equipment cannot move . . . when progress is menaced by idle shovels . . . when *penalties* threaten profits . . .

LINN defies the elements and keeps the job on schedule, despite ground and grades . . . and it frequently wins the *bonus!* Because the LINN was designed for the tough jobs and built to work under difficult conditions, it can also lengthen the contractor's working season.

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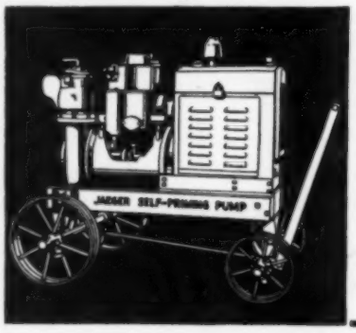

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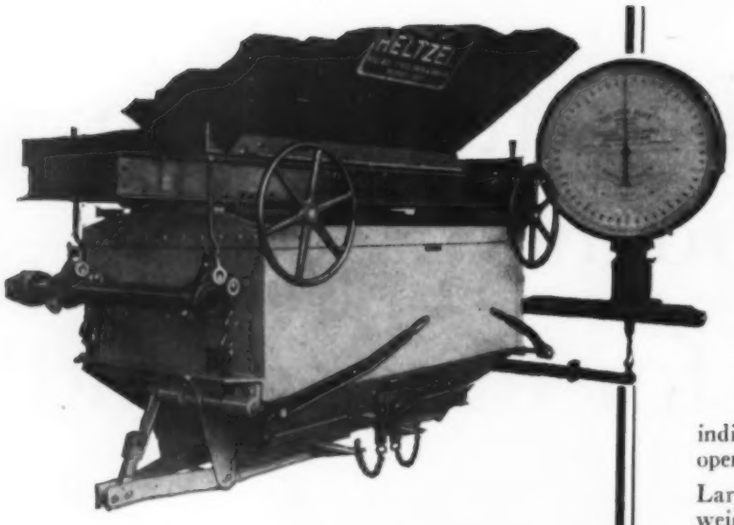

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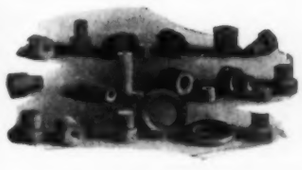

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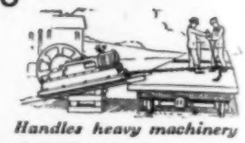

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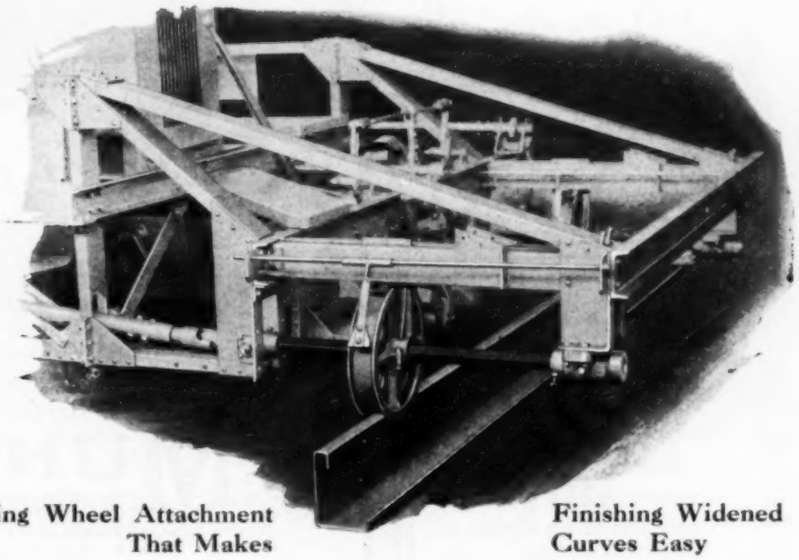

Sliding Wheel Attachment That Makes Finishing Widened Curves Easy

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Sliding wheel fixture enables you to finish widened curves with the machine without false forms. Adjustable for both 9 and 10-ft. roads. Type C., by changing cross members may be used on roads up to 30 feet width.

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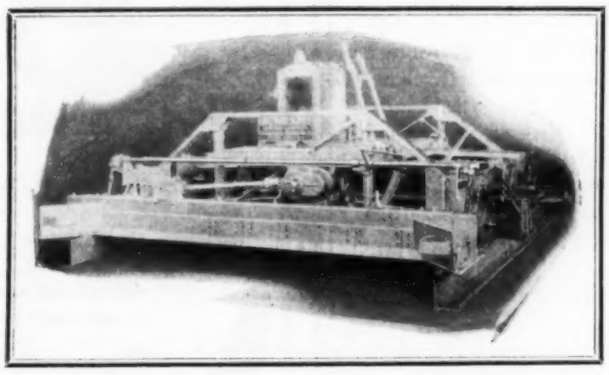

Type C. has full automotive construction — heat treated gears and shafts — Timken Roller Bearings, enclosed automotive type transmission.

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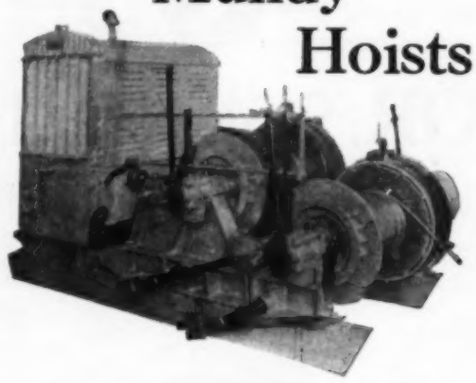

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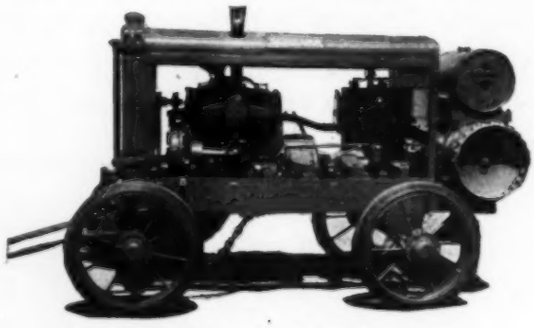

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— welds easier
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No other welder has all these features.

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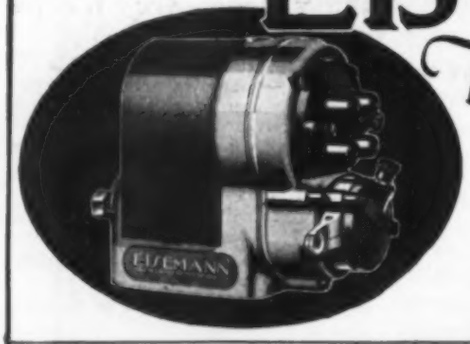

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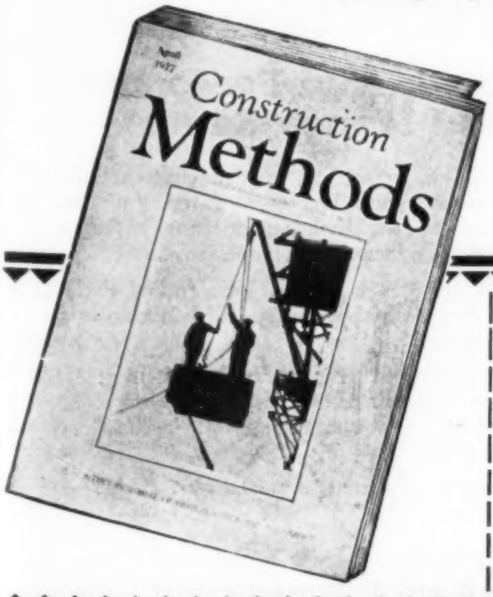

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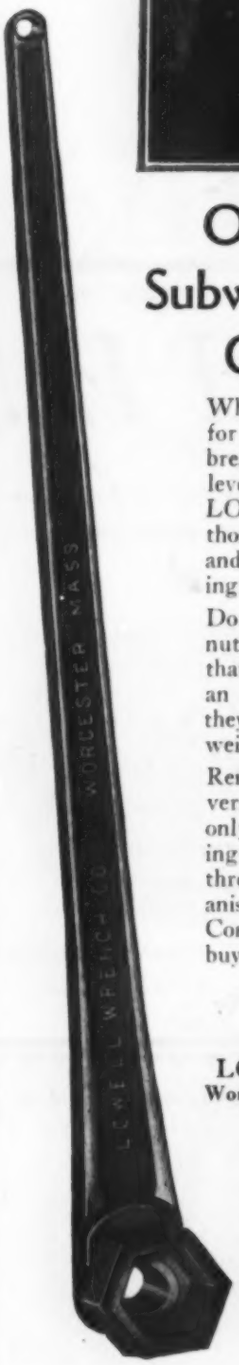

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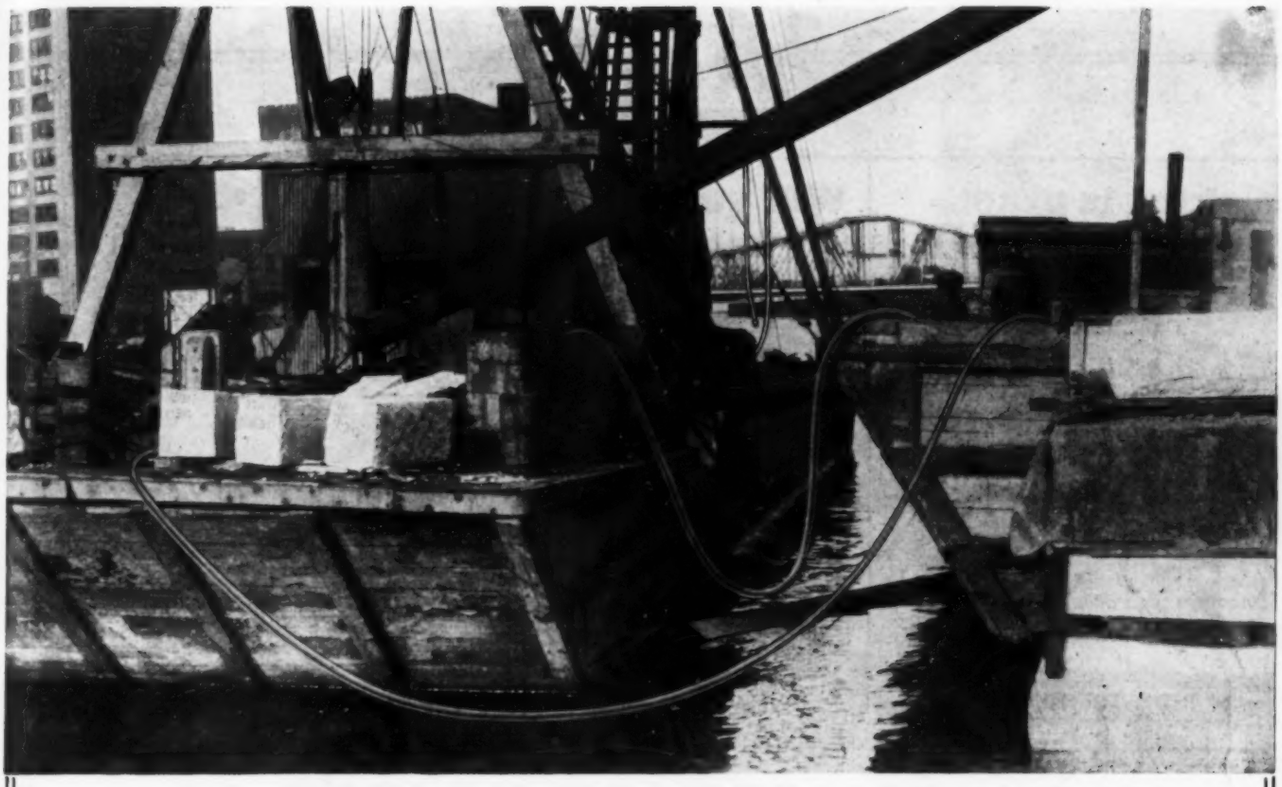

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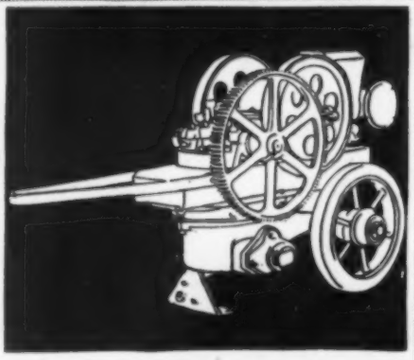

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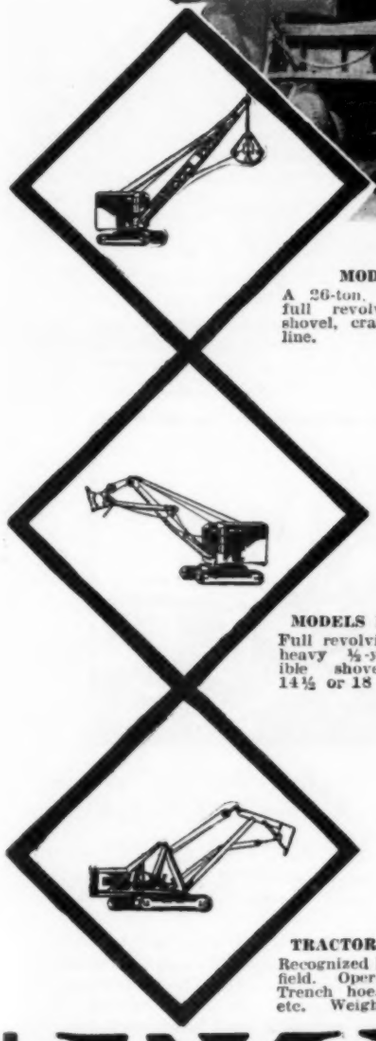

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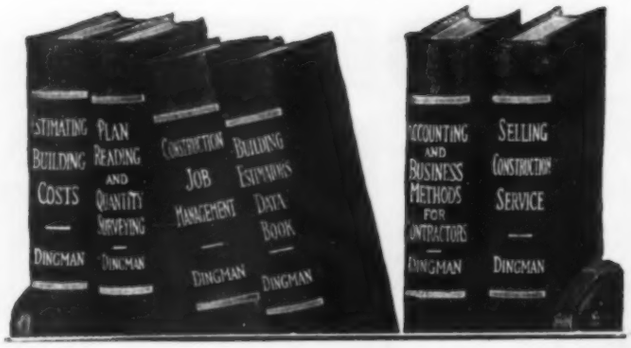

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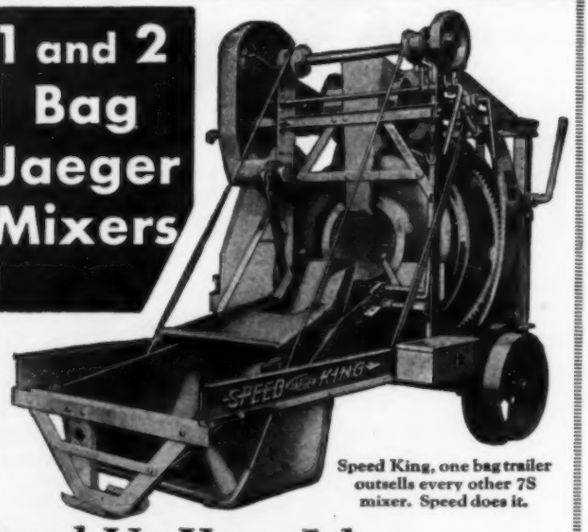

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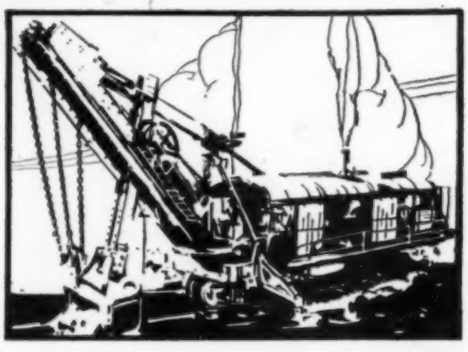

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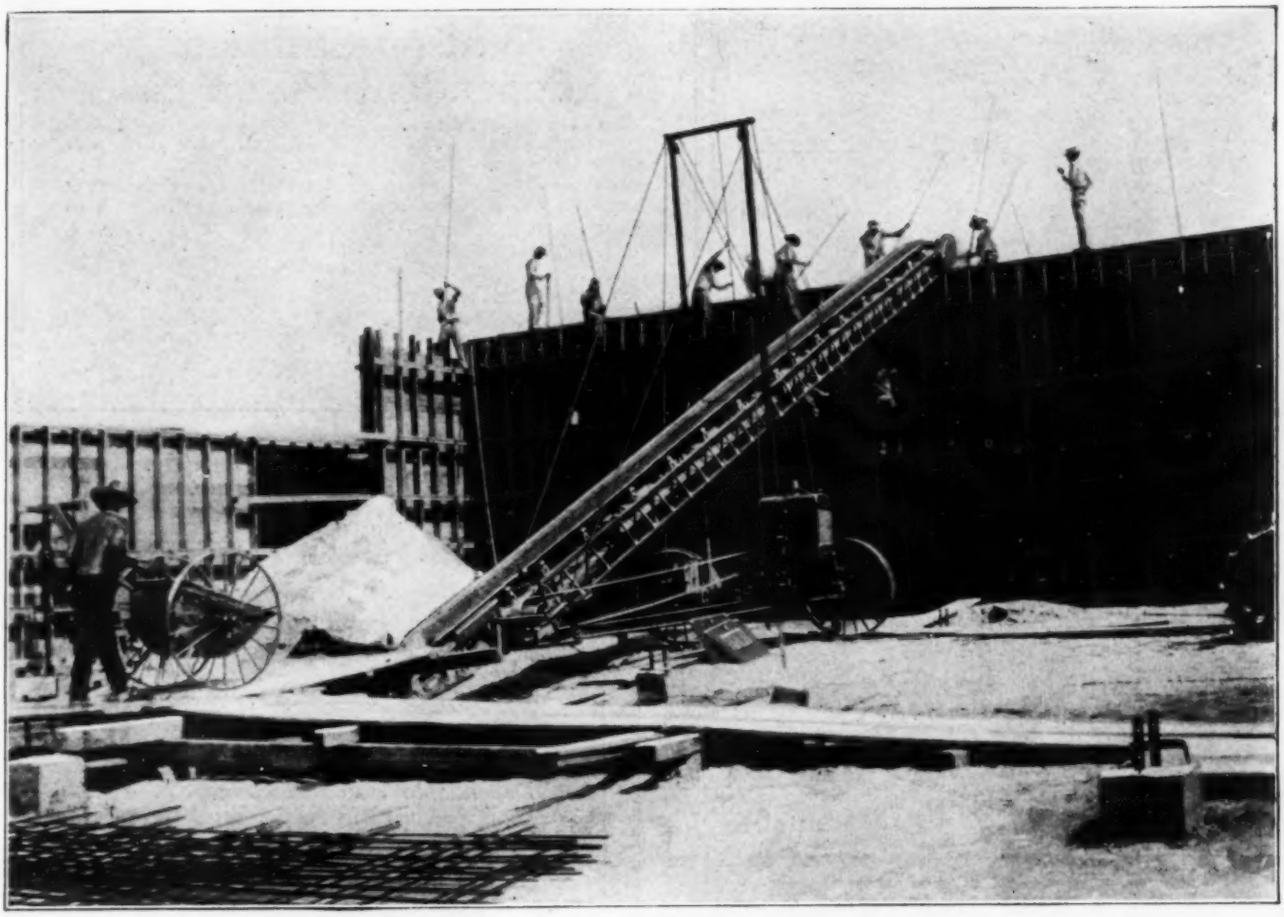

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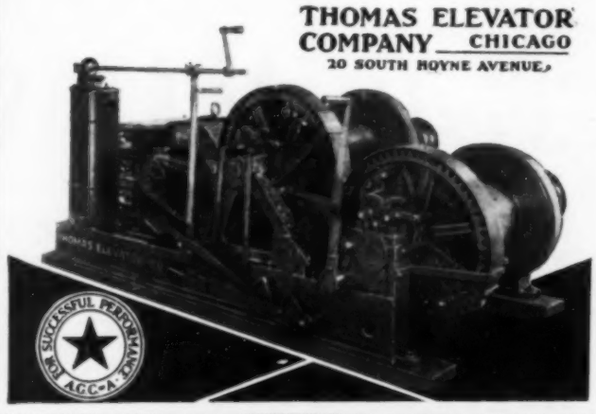

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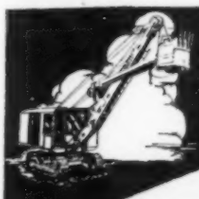

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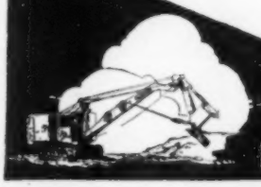

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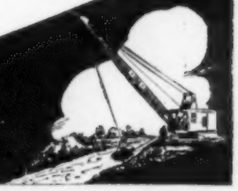

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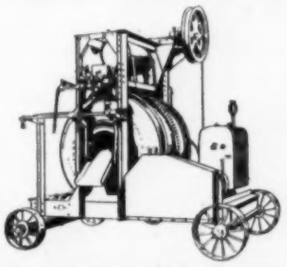

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